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THE DANISH "DANA"-EXPEDITIONS 1920—22
IN THE NORTH ATLANTIC AND THE GULF OF PANAMA
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THE FISHES
OF
THE FAMILIES ASTRONESTHIDAE AND CHAULIODONTIDAE

BY

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WITH 7 PLATES AND 25 FIGURES IN THE TEXT

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1. INTRODUCTION

The Astronesthidae, Chauliodontidae, and Stomiatidae (except *Stomias*) collected by the "Dana" have been sent to us for investigation. We have made a complete revision of the Astronesthidae and have described the Chauliodontidae; we are reserving the Stomiatidae for a separate report. Four new genera and seventeen new species of Astronesthidae are described, the "Dana" collection doubling the known species of this family. In addition there is a new *Chauliodus*, represented by more than a thousand specimens.

2. CLASSIFICATION OF THE STOMIATOID FISHES

The Stomiatoids are oceanic fishes of the order Isospondyli, essentially similar to the Clupeoids, but distinguished by the presence of photophores, which have a nearly constant arrangement throughout the group, comprising a series on the branchiostegal membrane between the branchiostegal rays, and two series on each side of the body, a ventral along the isthmus, thence below the pectoral and pelvic fins to the anal, and along the base of the anal to the caudal, and a lateral from above the pectoral to above the origin or anterior part of the anal. Other luminous dots and patches may by present, but the serial photophores are provided with a lens and are generally surrounded by pigment: according to BRAUER, in the Gonostomatidae and Sternoptychiidae these photophores typically have a lumen and duct, but in the Astronesthidae, Chauliodontidae and Stomiatidae there is no lumen or duct, and the light cells form a single series radially arranged round a core of fibrous tissue. The "Doppelorgan" of BRAUER appears to be constantly present below the eye; it consists of two photophores enclosed in one pigment sheath, with one lens dorsal and the other ventral, and with areas of transparent skin over the lenses.

The Stomiatoids are soft-rayed fishes with pectoral fins placed low and pelvics abdominal, mouth terminal with lateral cleft, toothed maxillary entering the gape, and wide gill openings. The ribs are borne by autogenous parapophyses, wedged into pits in the centra.

The Gonostomatidae are the most primitive family of the group: in them the praemaxillaries have no anterior pedicels, the maxillaries have two supplemental bones, the gill-arches are provided with gill-rakers, and the parietals are well-developed, meeting or approaching each other above the supraoccipital. The Sternoptychiidae agree with them in these features, but differ in certain characters of specialization. The Astronesthidae, Chauliodontidae and Stomiatidae (including for the present *Idiacanthus*, *Malacosteus*, and other aberrant genera) are three closely related families, distinguished by photophores without lumen or duct, by the presence of anterior expansions of the praemaxillaries that together form a pointed process that extends upwards and backwards over the mesethmoid, by having one supplemental maxillary or none, by the absence of gill-rakers, the gill-arches generally bearing teeth, and by having the parietals either small and widely separated, or absent. A barbel is generally present. A postocular luminous organ, an

enlarged photophore placed behind the eye and sometimes extending forward below it, is characteristic; the luminous body lies in a pocket covered by thin transparent skin; by rotation of the body the luminous surface can be turned downwards and inwards, and disappears; if in addition the mouth of the pocket closes up the organ may be hard to find.

The "Dana" specimens, having been originally preserved in formalin, are not very suitable for osteological study. We have examined skeletons of *Astronesthes* and *Chauliodus* in the collection of the Natural History Museum, and have tried to compare *Astronesthes* with other genera of the family.

3. STRUCTURE OF THE ASTRONESTHIDAE

The Astronesthidae are more or less elongate, naked fishes, with the mouth rather large, the suspensorium directed more or less obliquely backwards and the opercles narrow. The teeth in the praemaxillaries and lower jaw are acute, including some strong fixed barbed fangs in the more generalized forms. A postocular luminous organ and a hyoid barbel are present. The teeth on the gill-arches are well-developed, often in pairs. The dorsal fin originates above or behind the pelvics, rarely extends back to above the middle of the anal, and is generally followed by an adipose fin; the pectorals are placed low, the pelvics generally nearly in the middle of the length (farther back in *Heterophotus*).

In *Astronesthes niger* and *A. similis* the upper surface of the skull is broad and slightly convex, with the very large frontals forming the greater part of the cranial roof, and extending back on each side of the supraoccipital; immediately behind them the small transverse parietals cover the epiotics, which project backwards. At the anterior end of the skull the mesethmoid sends forwards a median projection, behind which lateral processes diverge outwards and support the lower ends of the lateral ethmoids. There is no opisthotic. In the orbital region the stout basisphenoid rests on the parasphenoid and supports the large wing-like alisphenoids; there is no orbitosphenoid.

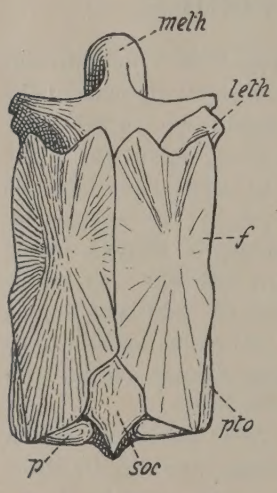

Fig. 1. *Astronesthes niger*. Skull seen from above. *f*, frontal; *leth*, lateral ethmoid; *meth*, mesethmoid; *p*, parietal; *pto*, pterotic; *soc*, supraoccipital.

The praemaxillaries have strong pointed processes anteriorly that lie over the median projection of the mesethmoid; the maxillary is adherent to the praemaxillary and bears a minute supplemental bone at its posterior end. The lower jaw consists mainly of dentary and angular.

The slender ectopterygoid connects the palatine with the quadrate, but the entopterygoid and metapterygoid are scarcely ossified; the praeoperculum is a slender splint attached to the oblique hyomandibular. The pectoral arch is complete, with a mesocoracoid, and with the post-temporal a triangular plate, acutely pointed in front.

The vertebrae (47 in number in *A. niger*) are thinly ossified: in the praecaudal region the slender ribs are attached to short parapophyses wedged into pits in the centra: there are no upturned vertebrae at the base of the caudal fin, and the uroneurals are ankylosed with the last centrum.

There is no air-bladder. The stomach is caecal, black, large, extending back to the pelvic fins; the intestine arises from near the anterior end of the stomach, and is straight, pale, and provided with one or two pyloric caeca.

The other genera seem to agree in most respects with *Astronesthes*, but we cannot detect parietal bones in *Borostomias*, *Diplolychnus* and *Heterophotus*. In *Neonesthes* the post-temporal is somewhat larger than in *Astronesthes*, and is of equal width throughout; in *Borostomias* it is a rather long, slender bone; in *Diplolychnus* there is no post-temporal, but the supracleithrum is attached to the skull by a strong ligament; in *Heterophotus* the supracleithrum is remote from the skull, and unconnected with it.

There can be little doubt that these differences are related to the size of the mouth, a large mouth pushing the cleithrum backwards. Except that the stomach is small in *Neonesthes*, the visceral anatomy is the same throughout the family.

4. LIST OF GENERA AND SPECIES OF ASTRONESTHIDAE

1. *Astronesthes*, Richardson.
   1. *splendidus*, A. Brauer.
   2. *filifer*, sp. n.
   3. *oculatus*, sp. n.
   4. *caulophorus*, sp. n.
   5. *similis*, Parr.
   6. *luetkeni*, sp, n.
   7. *richardsoni*, Poey.
   8. *martensii*, Klunzinger.
   9. *lucifer*, Gilbert.
   10. *ijimai*, Tanaka.
   11. *chrysophekadion*, Bleeker.
   12. *gemmifer*, Goode & Bean.
   13. *cyclophotus*, sp. n.
   14. *neopogon*, sp. n.
   15. *niger*, Richardson.
   16. *boulengeri*, Gilchrist.
   17. *cyaneus*, A. Brauer.
   18. *leucopogon*, sp. n.
   19. *longiceps*, sp. n.
   20. *indicus*, A. Brauer.
2. *Borostomias*, Regan.
   1. *abyssorum*, Koehler.
   2. *macrophthalmus*, sp. n.
   3. *antarcticus*, Loennberg.
   4. *schmidti*, sp. n.
   5. *braueri*, Regan.
   6. *elucens*, A. Brauer.
   7. *panamensis*, sp. n.
   8. *macristius*, sp. n.
3. *Diplolychnus*, gen. n.
   1. *lucifer*, sp. n.
   2. *mononema*, sp. n.
   3. *bifilis*, sp. n.
4. *Heterophotus*, gen. n.
   1. *ophistoma*, sp. n.
5. *Rhadinesthes*, gen. n.
   1. *decimus*, Zugmayer.
6. *Neonesthes*, gen. n.
   1. *macrolychnus*, sp. n.

5. STATIONS AT WHICH ASTRONESTHIDAE WERE TAKEN, WITH LIST OF SPECIMENS[1].

St. 400. Atlantic. (32° 10′ N. 17° 20′ W.).
Surface ..... 1 *Astronesthes niger* (27 mm.).

St. 414. Atlantic. (32° 10′ N. 38° W.).
34 M.W. ..... 2 *Astronesthes niger* (30, 32 mm.).

St. 437. Atlantic. (19° 11′ N. 64° 15′ W.).
Surface ..... 1 *Astronesthes similis* (20 mm.).

St. 445. Atlantic. (30° 50′ N. 44° 30′ W.).
..... 3 *Astronesthes niger* (33—36 mm.).
..... 2 — *leucopogon* (40, 45 mm.).

St. 446. Atlantic. (30° 10′ N. 45° 41′ W,).
415 M.W. ..... 1 *Astronesthes niger* (35 mm.).

[1] M.W. = metres of wire out, for lesser depths about 3 times, and for greater ones about twice the depth at which the nets were fished.

St. 451. Atlantic. (33° 42′ N. 36° 11′ W.).
85 M.W. ..... 1 *Astronesthes niger* (32 mm.).
St. 454. Atlantic. (35° N. 34° 30′ W.).
..... 1 *Astronesthes niger* (33 mm.).
St. 501. Atlantic. (25° N. 43° 30′ W.).
38 M.W. ..... 1 *Astronesthes niger* (26 mm.).
St. 516. Atlantic. (19° N. 30° W.).
66 M.W. ..... 1 *Astronesthes niger* (27 mm.).
St. 590. Atlantic. (17° 03′ N. 25° 37′ W.).
..... 1 *Astronesthes niger* (19 mm.).
St. 645. Atlantic. (34° 22′ N. 14° 57′ W.).
19 M.W. ..... 1 *Astronesthes niger* (25 mm.).
St. 654. Atlantic. (18° 56′ N. 59° 56′ W.).
19 M.W. ..... 1 *Astronesthes cyaneus* (16 mm).
St. 722. Atlantic. (15° 17′ N. 23° 50′ W.).
120 M.W. ..... 1 *Astronesthes cyaneus* (20 mm.).
1 — *filifer* (38 mm.).
St. 830. Atlantic. (24° 44′ N. 22° 32′ W.).
100 M.W. ..... 3 *Astronesthes indicus* (31—35 mm.).
300 M.W. ..... 2 — *indicus* (24, 30 mm.).
St. 831. Atlantic. (24° 34′ N. 28° 04′ W.).
100 M.W. ..... 1 *Astronesthes indicus* (25 mm.).
300 M.W. ..... 1 — *cyaneus* (46 mm.).
St. 878. Atlantic. (33° 24′ N. 14° 57′ W.).
100 M.W. ..... 1 *Astronesthes niger* (14 mm.).
St. 887. Atlantic. (26° 19′ N. 58° 58′ W.).
25 M.W. ..... 1 *Astronesthes niger* (27 mm.).
St. 926. Atlantic. (21° 15′ N. 46° 10′ W.).
200 M.W. ..... 1 *Astronesthes indicus* (19 mm.).
St. 935. Atlantic. (22° 44′ N. 51° 25′ W.).
150 M.W. ..... 1 *Astronesthes cyaneus* (34 mm.).
St. 939. Atlantic. (26° 10′ N. 56° 30′ W.).
500 M.W. ..... 1 *Astronesthes similis* (106 mm.).
St. 949. Atlantic. (21° 40′ N. 66° 55′ W.).
300 M.W. ..... 1 *Astronesthes cyaneus* (25 mm.).
St. 950. Atlantic. (20° 50′ N. 66° 30′ W.).
200 M.W. ..... 2 *Astronesthes indicus* (30, 34 mm.).
St. 952. Atlantic. (17° 55′ N. 64° 48′ W.).
50 M.W. ..... 1 *Astronesthes indicus* (28 mm.).
400 M.W. ..... 1 — *filifer* (22 mm.).
St. 1031. Atlantic. (33° 18′ N. 56° 03′ W.).
80 M.W. ..... 1 *Astronesthes similis* (22 mm.).
St. 1042. Atlantic. (30° 55′ N. 58° 48′ W.).
80 M.W. ..... 1 *Astronesthes cyclophotus* (22 mm.).
St. 1044. Atlantic. (32° 14′ N. 63° 51′ W.).
10 M.W. ..... 2 *Astronesthes niger* (15, 21 mm.).

St. 1056. Atlantic. (30° 53′ N. 52° 47′ W.).		
110 M.W.	1	*Astronesthes niger* (22 mm.).
St. 1058. Atlantic. (29° 24′ N. 48° 08′ W.).		
Surface	2	*Astronesthes niger* (31, 44 mm.).
10 M.W.	1	— *longiceps* (25 mm.).
110 M.W.	1	— *niger* (15 mm.).
	2	— *cyclophotus* (20, 21 mm.).
St. 1063. Atlantic. (21° 47′ N. 47° 11′ W.).		
25 M.W.	1	*Astronesthes similis* (22 mm.).
St. 1066. Atlantic. (24° 43′ N. 52° 18′ W.).		
110 M.W.	1	*Astronesthes indicus* (18 mm.).
St. 1072. Atlantic. (20° 26′ N. 61° 03′ W.).		
80 M.W.	2	*Astronesthes similis* (20, 55 mm.).
	4	— *indicus* (16—22 mm.).
St. 1142. Atlantic. (33° 26′ N. 16° 59′ W.).		
300 M.W.	1	*Astronesthes leucopogon* (24 mm.).
St. 1148. Atlantic. (32° 55′ N. 21° 51′ W.).		
500 M.W.	1	*Astronesthes cyclophotus* (26 mm.).
St. 1153. Atlantic. (28° 48′ N. 20° 45′ W.).		
300 M.W.	1	*Astronesthes cyclophotus* (21 mm.).
300 M.W.	1	— *indicus* (12 mm.).
500 M.W.	1	— — (12 mm.).
St. 1155. Atlantic. (26° 15′ N. 20° 53 W.).		
200 M.W.	1	*Astronesthes cyclophotus* (28 mm.).
300 M.W.	1	— *cyaneus* (16—21 mm.).
	1	— *indicus* (11 mm.).
St. 1156. Atlantic. (25° 11′ N. 20° 57′ W.).		
1000 M.W.	1	*Diplolychnus lucifer* (245 mm.).
St. 1158. Atlantic. (19° 22′ N. 24° 06′ W.).		
Surface	2	*Astronesthes niger* (31, 44 mm.)
500 M.W.	1	— *indicus* (103 mm.).
600 M.W.	1	— — (75 mm.).
St. 1159. Atlantic. (17° 55′ N. 24° 35′ W.).		
Surface	2	*Astronesthes niger* (29, 36 mm.).
3000 M.W.	3	— — (26 mm.).
	1	— *indicus* (25 mm.).
	1	*Borostomias schmidti* (185 mm.).
St. 1160. Atlantic. (15° 50′ N. 26° 30′ W.).		
Surface	5	*Astronesthes niger* (25—32 mm.).
100 M.W.	2	— *filifer* (25, 40 mm.).
600 M.W.	1	— *cyaneus* (36 mm.).
1000 M.W.	2	*Neonesthes macrolychnus* (140, 144 mm.)
St. 1161. Atlantic. (14° 52′ N. 28° 04′ W.).		
Surface	1	*Astronesthes filifer* (25 mm.).
	10	— *niger* (25—46 mm.).
100 M.W.	3	— *filifer* (20—50 mm.).
600 M.W.	1	— — (20 mm.).

St. 1162. Atlantic. (13° 35′ N. 30° 11′ W.).
300 M.W. ..... 1 *Astronesthes filifer* (56 mm.).
1 — *caulophorus* (34 mm.).
St. 1163. Atlantic. (12° 59′ N. 32° 49′ W.).
100 M.W. ..... 1 *Astronesthes filifer* (37 mm.).
300 M.W. ..... 1 — *gemmifer* (22 mm.).
1 — *indicus* (15 mm.).
600 M.W. ..... 1 *Heterophotus ophistoma* (210 mm.).
St. 1165. Atlantic. (12° 11′ N. 35° 49′ W.).
Surface ..... 2 *Astronesthes niger* (35, 36 mm.).
100 M.W. ..... 1 — *filifer* (23 mm.).
1000 M.W. ..... 1 — *indicus* (85 mm.).
2000 M.W. ..... 2 — *filifer* (20, 21 mm.).
1 *Borostomias braueri* (75 mm.).
3000 M.W. ..... 1 *Astronesthes filifer* (35 mm.).
5000 M.W. ..... 1 *Borostomias braueri* (50 mm.).
St. 1166. Atlantic. (10° 16′ N. 40° 41′ W.).
100 M.W. ..... 1 *Astronesthes filifer* (24 mm.).
1 — *indicus* (28 mm.).
300 M.W. ..... 1 — *filifer* (30 mm.).
1000 M.W. ..... 1 *Heterophotus ophistoma* (300 mm.).
St. 1168. Atlantic. (9° 30′ N. 42° 41′ W.).
50 M.W. ..... 2 *Astronesthes filifer* (42 mm.).
100 M.W. ..... 2 — — (43, 52 mm.).
600 M.W. ..... 1 *Heterophotus ophistoma* (182 mm.).
St. 1171. Atlantic. (8° 19′ N. 44° 35′ W.).
50 M.W. ..... 2 *Astronesthes filifer* (32, 33 mm.).
6000 M.W. ..... 1 — *indicus* (50 mm.).
St. 1172. Atlantic. (7° 22′ N. 46° 51′ W.).
300 M.W. ..... 4 *Astronesthes filifer* (33—62 mm.).
600 M.W. ..... 1 *Heterophotus ophistoma* (205 mm.).
St. 1174. Atlantic. (5° 35′ N. 51° 08′ W.).
300 M.W. ..... 1 *Astronesthes filifer* (60 mm.).
St. 1178. Atlantic. (10° 24′ N. 54° 38′ W.).
300 M.W. ..... 3 *Astronesthes filifer* (20—30 mm.).
St. 1181. Atlantic. (13° 07′ N. 57° 20′ W.).
3000 M.W. ..... 1 *Astronesthes filifer* (18 mm.).
1 — *niger* (20 mm.).
St. 1182. Atlantic. (13° 03′ N. 59° 50′ W.).
300 M.W. ..... 5 *Astronesthes cyaneus* (18—24 mm.).
St. 1183. Caribbean Sea, W. of St. Lucia. (13° 47′ N. 61° 26′ W.).
50 M.W. ..... 1 *Astronesthes similis* (20 mm.).
300 M.W. ..... 1 — *filifer* (23 mm.).
1500 M.W. ..... 1 — *cyaneus* (20 mm.).
2500 M.W. ..... 1 — *filifer* (20 mm.).
1 — *niger* (18 mm.).

St. 1183. Caribbean Sea, W. of St. Lucia. (13° 47′ N. 61° 26′ W.).
3500 M.W. ..... 1 *Astronesthes gemmifer* (160 mm.).
1 — *cyaneus* (20 mm.).
St. 1184. Caribbean Sea, SW. of Dominica. (15° 08′ N. 61° 31′ W.).
600 M.W. ..... 1 *Astronesthes filifer* (20 mm.).
1 — *similis* (22 mm.).
St. 1185. Atlantic, W. of Barbuda. (17° 41′ N. 60° 58′ W.).
100 M.W. ..... 2 *Astronesthes similis* (22, 24 mm.).
300 M.W. ..... 1 — *indicus* (17 mm.).
800 M.W. ..... 3 — — (10—15 mm.).
1000 M.W. ..... 1 — — (17 mm.).
3000 M.W. ..... 1 — — (11 mm.).
4000 M.W. ..... 1 — — (62 mm.).
St. 1186. Caribbean Sea, S. of Virgin Islands. (17° 54′ N. 64° 54′ W.).
50 M.W. ..... 1 *Astronesthes similis* (20 mm.).
100 M.W. ..... 1 — — (40 mm.).
1 — *niger* (20 mm.).
600 M.W. ..... 1 — *cyaneus* (20 mm.).
3000 M.W. ..... 2 — *niger* (18 mm.).
St. 1189. Caribbean Sea, S. of Virgin Islands (17° 58,5′ N. 64° 41′ W.).
3000 M.W. ..... 2 *Astronesthes niger* (17 mm.).
St. 1194. Caribbean Sea, S. of Virgin Islands. (17°58,5′ N. 64° 41′ W.).
306 M.W. ..... 1 *Astronesthes niger* (17 mm.).
1 — *indicus* (30 mm.).
312 M.W. ..... 1 — — (50 mm.).
2 — *cyaneus* (26, 28 mm.).
St. 1195. Atlantic, N. of Virgin Islands. (19° 01′ N. 65° 23′ W.).
300 M.W. ..... 1 *Astronesthes similis* (32 mm.).
1 — *indicus* (45 mm.).
600 M.W. ..... 3 — — (20—52 mm.).
St. 1198. Caribbean Sea, W. of St. Croix. (17° 43′ N. 64° 56′ W.).
500 M.W. ..... 2 *Astronesthes cyaneus* (32, 35 mm.).
St. 1202. Caribbean Sea, off Colon. (9° 40′ N. 79° 56′ W.).
50 M.W. ..... 1 *Astronesthes cyaneus* (28 mm.),
1000 M.W. ..... 1 *Heterophotus ophistoma* (260 mm.).
St. 1206. Gulf of Panama. (6° 40′ N. 80° 47′ W.).
3000 M.W. ..... 1 *Borostomias macristius* (155 mm.).
St. 1208. Gulf of Panama. (6° 48′ N. 80° 33′ W.).
3600 M.W. ..... 1 *Borostomias panamensis* (208 mm.).
St. 1214. Caribbean Sea, S. of Jamaica (14° 21′ N. 76° 50′ W.).
50 M.W. ..... 1 *Astronesthes similis* (25 mm.).
100 M.W. ..... 1 — *cyaneus* (15 mm.).
300 M.W. ..... 1 — — (15 mm.).
St. 1216. Caribbean Sea, W. of Jamaica. (18° 22′ N. 78° 38′ W.).
100 M.W. ..... 1 *Astronesthes niger* (14 mm.).
300 M.W. ..... 1 — *cyaneus* (27 mm.).

St. 1217. Caribbean Sea, W. of Jamaica (18° 50′ N. 79° 07′ W.).
500 M.W. ..... 2 *Astronesthes niger* (14 mm.).
1500 M.W. ..... 2 — *similis* (20 mm.).
1 — *cyaneus* (15 mm.).
2500 M.W. ..... 1 *Heterophotus ophistoma* (205 mm.).
3000 M.W. ..... 1 *Astronesthes cyaneus* (18 mm.).
1 *Borostomias braueri* (175 mm.).
St. 1223. W. of Cuba. (22° 06′ N. 84° 58′ W.).
500 M.W. ..... 1 *Astronesthes similis* (88 mm.).
St. 1225. Gulf of Mexico. (23° 58′ N. 83° 22′ W.).
300 M.W. ..... 1 *Astronesthes cyaneus* (28 mm.).
St. 1228. Between Florida and Cuba. (23° 35′ N. 81° 54′ W.).
600 M.W. ..... 1 *Astronesthes similis* (20 mm.).
St. 1229. Off Habana. (23° 13′ N. 82° 21′ W.),
100 M.W. ..... 1 *Astronesthes similis* (36 mm.).
St. 1242. W. of S. Salvador. (24° 05′ N. 74° 36′ W.).
800 M.W. ..... 1 *Astronesthes cyaneus* (25 mm.).
St. 1243. Bahama Channel. (21° 04′ N. 73° 48′ W.).
1000 M.W. ..... 1 *Neonesthes macrolychnus* (50 mm.).
St. 1245. W. of Haïti. (19° 35′ N. 73° 27′ W.).
50 M.W. ..... 1 *Astronesthes niger* (14 mm.).
100 M.W. ..... 1 — *filifer* (36 mm.).
1 — *cyaneus* (22 mm.).
300 M.W. ..... 1 — *niger* (12 mm.).
1000 M.W. ..... 1 — *resplendens* (50 mm.).
St. 1247. S. of Haïti. (17° 57′ N. 72° 51 W.).
100 M.W. ..... 1 *Astronesthes filifer* (35 mm.).
300 M.W. ..... 1 — *cyaneus* (18 mm.).
St. 1250. W. of Puerto Rico. (17° 54′ N. 67° 30′ W.).
100 M.W. ..... 1 *Astronesthes similis* (45 mm.).
300 M.W. ..... 2 — *cyaneus* (35 mm.).
600 M.W. ..... 1 — — (38 mm.).
St. 1253. Caribbean Sea, W. of St. Croix. (17° 43′ N. 64° 56′ W.).
300 M.W. ..... 1 *Astronesthes similis* (30 mm.).
3 — *cyaneus* (52—60 mm.).
600 M.W. ..... 1 — — (40 mm.).
St. 1257. Caribbean Sea, W. of St. Croix. (17° 43′ N. 64° 56′ W.).
300 M.W. ..... 4 *Astronesthes cyaneus* (35—60 mm.).
St. 1260. Atlantic, N. of Puerto Rico. (18° 31′ N. 66° 00′ W.).
600 M.W. ..... 1 *Astronesthes cyaneus* (38 mm.).
St. 1261. Atlantic, N. of Porto Rico. (19° 04′ N. 65° 43′ W.).
2500 M.W. ..... 2 *Astronesthes indicus* (22, 25 mm.).
St. 1266. Caribbean Sea, W. of St. Croix. (17° 45′ N. 64° 55,5′ W.).
800 M.W. ..... 1 *Astronesthes oculatus* (145 mm.).
St. 1267. Caribbean Sea, N. of St. Croix. (17° 56′ N. 64° 50′ W.).
4000 M.W. ..... 1 *Astronesthes indicus* (36 mm.).

St. 1269. Caribbean Sea, S. of St. Croix. (17° 13′ N. 64° 58′ W.).
600 M.W. ..... 1 *Astronesthes cyaneus* (25 mm.).
St. 1270. Caribbean Sea, W. of St. Croix. (17° 43′ N. 64° 56′ W.).
1000 M.W. ..... 1 *Astronesthes indicus* (88 mm.).
St. 1272. Caribbean Sea, W. of St. Croix. (17° 43′ N. 64° 56′ W.).
300 M.W. ..... 1 *Astronesthes similis* (60 mm.).
St. 1273. Caribbean Sea, W. of St. Croix. (17° 43′ N. 64° 56′ W.).
600 M.W. ..... 2 *Astronesthes cyaneus* (51, 76 mm.).
St. 1274. Caribbean Sea, W. of St. Croix. (17° 43′ N. 64° 56′ W.).
100 M.W. ..... 1 *Astronesthes indicus* (41 mm.).
St. 1276. Caribbean Sea, W. of St. Croix. (17° 43′ N. 64° 56′ W.).
800 M.W. ..... 1 *Astronesthes indicus* (28 mm.).
St. 1278. Caribbean Sea, W. of St. Croix. (17° 43′ N. 64° 56′ W.).
300 M.W. ..... 1 *Astronesthes similis* (21 mm.).
1 — *cyaneus* (50 mm.).
St. 1279. Caribbean Sea, W. of St. Croix. (17° 43′ N. 64° 56′ W.).
300 M.W. ..... 1 *Astronesthes similis* (77 mm.).
1000 M.W. ..... 1 *Diplolychnus mononema* (255 mm.).
St. 1281. Caribbean Sea, W. of St. Croix. (17° 43′ N. 64° 56′ W.).
300 M.W. ..... 1 *Astronesthes similis* (22 mm.).
2 — *cyaneus* (43, 70 mm.).
1000 M.W. ..... 1 *Diplolychnus mononema* (85 mm.).
1200 M.W. ..... 1 *Astronesthes cyaneus* (44 mm.).
St. 1282. Caribbean Sea, W. of Guadeloupe. (16° 03′ N. 62° 29′ W.).
600 M.W. ..... 1 *Astronesthes similis* (110 mm.).
St. 1285. Caribbean Sea, W. of Martinique. (14° 38′ N. 61° 16′ W.).
600 M.W. ..... 1 *Heterophotus ophistoma* (45 mm.).
St. 1287. Caribbean Sea, W. of Guadeloupe. (16° 04′ N. 61° 52 W.).
1000 M.W. ..... 1 *Heterophotus ophistoma* (202 mm.).
St. 1289. Caribbean Sea, W. of St. Croix. (17° 43′ N. 64° 56′ W.).
300 M.W. ..... 1 *Astronesthes cyaneus* (35 mm.).
700 M.W. ..... 1 — — (70 mm.).
St. 1291. Caribbean Sea, W. of St. Croix. (17° 43′ N. 64° 56′ W.).
300 M.W. ..... 3 *Astronesthes cyaneus* (41—47 mm.).
St. 1292. Caribbean Sea, W. of St. Croix. (17° 43′ N. 64° 56′ W.).
100 M.W. ..... 1 *Astronesthes indicus* (44 mm.).
300 M.W. ..... 2 — *cyaneus* (43, 45 mm.).
St. 1293. Caribbean Sea, W. of St. Croix. (17° 43′ N. 64° 56′ W.).
300 M.W. ..... 1 *Astronesthes similis* (150 mm.).
2 — *cyaneus* (34, 48 mm.).
St. 1294. Caribbean Sea, W. of St. Croix. (17° 43′ N. 64° 56′ W.).
100 M.W. ..... 3 *Astronesthes indicus* (29—51 mm.).
St. 1296. Caribbean Sea, W. of St. Croix. (17° 43′ N. 64° 56′ W.).
100 M.W. ..... 3 *Astronesthes indicus* (31—38 mm.).
St. 1310. Caribbean Sea, W. of St. Croix. (17° 43′ N. 64° 56′ W.).
300 M.W. ..... 1 *Astronesthes cyaneus* (40 mm.).
1 — *indicus* (54 mm.).

St. 1314. Caribbean Sea, W. of St. Croix. (17° 43′ N. 64° 56′ W.).
100 M.W. ..... 1 *Astronesthes indicus* (54 mm.).
300 M.W. ..... 1 — *cyaneus* (43 mm.).
St. 1322. Atlantic. 27° 02′ N. 53° 39′ W.).
900 M.W. ..... 1 *Astronesthes niger* (25 mm.).
St. 1342. Atlantic. (34° 00′ N. 70° 01′ W.).
150 M.W. ..... 1 *Astronesthes niger* (15 mm.).
1 — *gemmifer* (40 mm.).
St. 1352. Atlantic. (35° 42′ N. 73° 43′ W.).
100 M.W. ..... 2 *Astronesthes similis* (20 mm.).
300 M.W. ..... 1 — — (70 mm.).
St. 1353. Atlantic. (33° 51′ N. 66° 43′ W.).
200 M.W. ..... 1 *Neonesthes macrolychnus* (38 mm.).
St. 1358. Atlantic. (28° 15′ N. 56° 00′ W.).
300 M.W. ..... 1 *Neonesthes macrolychnus* (35 mm.).
St. 1365. Atlantic. (31° 47′ N. 41° 41′ W.).
1000 M.W. ..... 1 *Neonesthes macrolychnus* (42 mm.).
St. 1368. Atlantic. (34° 40′ N. 33° 16′ W.).
1000 M.W. ..... 1 *Astronesthes neopogon* (125 mm.).
St. 1372. Atlantic. (37° 23′ N. 26° 02′ W.).
3000 M.W. ..... 1 *Astronesthes niger* (27 mm.).
St. 1378. Atlantic. (37° 44′ N. 25° 56′ W.).
200 M.W. ..... 1 *Astronesthes niger* (41 mm.).
St. 1387. Atlantic. (46° 28′ N. 8° 01′ W.).
4000 M.W. ..... 1 *Diplolychnus bifilis* (65 mm.).

A noteworthy feature of the above list is that only two specimens, each representing a new species of *Borostomias*, were taken in the Gulf of Panama, in striking contrast to the rich hauls of Ceratioids made in that region. *Astronesthes*, widely distributed in the tropical and temperate Atlantic, and in the Indo-Pacific to Japan and the Sandwich Islands, is not yet recorded from the eastern Pacific.

The species of *Astronesthes* are small, rarely attaining a length of more than 150 mm. They appear to occur at no great depth below the surface, even the larger ones at about 100 to 300 metres down (cf. St. 1293, *A. similis* of 150 mm. with 300 metres of wire out, St. 1158, *A. indicus* of 103 mm. with 500 metres of wire out, etc.). The species of *Borostomias* may live at greater depths; they were taken by the Dana only with 2000 or more metres of wire out. Large specimens of *Diplolychnus mononema* were taken with 1000 metres of wire out (St. 1279, 1281), and of *Heterophotus* with 600 metres of wire out (Sts. 1163, 1172), *Neonesthes* of 140 and 144 mm. were taken at St. 1160 with 1000 metres of wire out. From these data it appears that, with the possible exception of *Borostomias*, the *Astronesthidae* mainly occur at not more than 500 metres below the surface.

6. SYSTEMATIC REVISION OF THE ASTRONESTHIDAE

Synopsis of the Genera.

I. Teeth on gill-arches relatively few and short; none on ceratohyal.
A. Maxillary teeth directed obliquely backwards ..... 1. *Astronesthes*
B. Maxillary long, with a series of erect curved teeth; body moderately elongate.
Photophores nearly equidistant; postocular luminous organ single; maxillary with 6 to 10 teeth ..... 2. *Borostomias*

Photophores nearly equidistant; postocular luminous organ double; maxillary with 12 to 16 teeth in adult ..... 3. *Diplolychnus*

Ventral photophores mostly in linear groups; maxillary teeth small and numerous ..... 4. *Heterophotus*

C. Maxillary short, with a few minute teeth; body very elongate..... 5. *Rhadinesthes*

II. Teeth on gill arches numerous, long and slender, almost setiform; a series of similar teeth on cerato-hyal..... 6. *Neonesthes*

1. ASTRONESTHES, Richardson, 1845.

Voy. Sulphur, Ichth. p. 97.

Bathylychnus, A. Brauer (1902); Valdivia Tiefseefische, p. 34 (1906).

Cleft of mouth straight. Praemaxillaries and lower jaw with some strong sharp fangs, curved, with ends straight and slightly barbed. Maxillary with a close-set series of teeth, which are directed obliquely backwards. A pair of teeth on vomer, and a series on each palatine. Gill-arches with rather small teeth mostly in pairs; none on cerato-hyal. Postocular luminous organ single. Dorsal fin of 10 to 21 rays, anal of 12 to 22. Post-temporal a triangular plate. Stomach large.

Atlantic: Indo-Pacific to Japan and Sandwich Islands.

Synopsis of the Species.[1]

I. Dorsal 11, beginning far behind pelvics, ending a short distance before anal .... 1. *splendidus*

II. Dorsal 10—14, beginning behind pelvics, ending well in front of anal.

A. D. 12—14. Caudal photophores a continuous series. Eye less than $^1/_3$ length of head.

1. Dorsal beginning well behind pelvics.

Postocular luminous organ close to eye; diameter of eye 5 to 6 in length of head (in specimens of 20—62 mm) ..... 2. *filifer*

Postocular luminous organ close to eye; diameter of eye $3^3/_4$ in length of head (in a specimen of 145 mm) ..... 3. *oculatus*

Postocular luminous organ remote from eye..... 4. *caulophorus*

2. Dorsal beginning a little behind pelvics

Anal 19—21..... 5. *similis*

Anal 15; barbel $1^1/_2$ head, ending in a bulb ..... 6. *luetkeni*

Anal 13; barbel shorter than head, tapering..... 7. *richardsoni*

B. D. 10—13. Caudal photophores 10—13, 2 or 3 (6th to 9th) above level of others. Eye less than $^1/_3$ head.

Anal 19—22. Photophores in ventral series P.-V. 17—18, V.-A. 18—20 8. *martensii*

Anal 19—20. Photophores in ventral series P.-V. 18—20, V.-A. 21—24 9. *lucifer*

Anal 12—16 ..... 10. *ijimai*

C. D. 12; A. 20. Eye $^1/_3$ length of head (in a specimen of 115 mm)... 11. *chrysophekadion*

III. Dorsal 15—17, beginning above pelvics and ending before anal. Anal 16—19. Ventral photophores P.-V. 17—19; V.-A. 27—28 ..... 12. *gemmifer*

IV. Dorsal 14—21, beginning above or behind pelvics, extending to above origin of anal, or nearly, or beyond. Anal 12—17. Ventral photophores P.-V. 5—19; V.-A. 8—21.

A. Ventral photophores P.-V. 17—19; V.-A. 17—18.

Barbel slender, black, with tapering white tip ..... 13. *cyclophotus*

Barbel stout, compressed, white ..... 14. *neopogon*

[1] In species 1 the distance from snout to dorsal exceeds that from snout to pelvics by 13 % of the length to base of caudal, in species 2—4 by 8—12 %, in species 5 to 7 by 5 % or less, in species 8—10 by 3—7 %.

B. Ventral photophores P.-V. 12—15; V.-A. 17—21.
  D. 14—18. Adult with a luminous patch on shoulder ..... 15. *niger*
  D. 16. Adult with luminous patches in pelvic region and on tail, but not on shoulder ..... 16. *boulengeri*
  D. 18—21. A luminous patch on operculum ..... 17. *cyaneus*
C. Ventral photophores P.-V. 10—11; V.-A. 13—15.
  A. 17 ..... 18. *leucopogon*
  A. 13 ..... 19. *longiceps*
D. Ventral photophores P.-V. 5—6; V.-A. 8—9 ..... 20. *indicus*

1. ASTRONESTHES SPLENDIDUS A. Brauer, 1902.

Zool. Anz. XXV, no. 668, p. 288.

Astronesthes martensii Brauer, "Valdivia" Tiefseefische, p. 32, Taf. II, fig. 4 (1906).

Depth of body $6^1/_5$ in length, length of head $4^2/_5$. Diameter of eye $4^2/_3$ in length of head. Post-ocular luminous organ conspicuous, well separated from eye. Barbel a little longer than head, with an elongate white bulb having a black spot at its tip and bearing about 8 fine terminal filaments. Dorsal

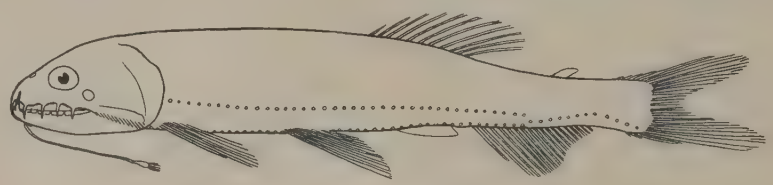

Fig. 2. *Astronesthes splendidus* (× 3). After Brauer.

11, originating well behind pelvics and ending a little in front of anal; distance from snout to dorsal exceeds that from snout to pelvics by 13 % of length without caudal. Anal 18. Pectoral 8. Pelvics 7-rayed, nearer to end of snout than to base of caudal. A dorsal adipose fin, and a long, low ventral adipose fin. Photophores in ventral series I.-P. 10; P.-V. 17; V.-A. 20; A.-C. 12; in lateral series O.-A. 37.

Type 31 mm. in length to base of caudal, from the Indian Ocean.

2. ASTRONESTHES FILIFER sp. n.

(Pl. I, fig. 1)

"Astronesthes martensii?" Lütken, 1892. Danske Vidensk. Selsk. Skrift. (6) VIII, p. 277, fig. .

? Astronesthes martensi Parr, Bull. Bingham Ocean. Coll. III. (2) 1927, p. 34.

Depth of body 6 to 8 in length, length of head $3^3/_4$ to $4^1/_2$. Diameter of eye 5 to 6 in length of head, interorbital width $3^1/_2$ to 4. Post-ocular luminous organ very close to eye. Barbel white, tapering, about $^2/_3$ length of head, less in young fish. Palatine teeth weak, 2 or 3 on each side. Dorsal 12—14, originating well behind pelvics and ending well in front of anal; distance from snout to dorsal exceeding that from snout to pelvics by 9 to 12 % of length without caudal. Anal 15—18. Pectoral 8. Pelvics 7-rayed, a little nearer to end of snout than to base of caudal. A dorsal adipose fin, and a long, rather low ventral adipose fin. Photophores in ventral series I.-P. 10—11; P.-V. 15—17; V.-A. 19—22; A.-C. 11—12; in lateral series O.-V. 14—15; V.-A. 19—22. In older fishes about four small white spots between post-ocular luminous organ and præoperculum, and three or four on præoperculum.

Atlantic; Caribbean Sea.

37 specimens 20 to 62 mm. in length to base of caudal, from stations 722, 952, 1160, 1161, 1162, 1163, 1165, 1166, 1168, 1171, 1172, 1174, 1178, 1181, 1183, 1184, 1245, and 1247, with 0 to 3000 metres of wire out.

3. ASTRONESTHES OCULATUS sp. n.

(Pl. I, fig. 2.)

Depth of body $6^1/_2$ in length, length of head 5. Diameter of eye $3^3/_4$ in length of head, inter-orbital width $3^1/_4$. Post-ocular luminous organ very close to eye. Barbel $^2/_3$ length of head, tapering, white on posterior side, black on anterior side; a small, elongate terminal bulb, scarcely thicker than distal portion of stem. Palatine teeth weak, 4 on each side. Dorsal 13, originating behind pelvics and ending well in front of anal; distance from snout to dorsal exceeds that from snout to pelvics by $8^0/_0$ of length without caudal. Anal 15. Pectoral 8. Pelvics 7-rayed, nearer to end of snout than to base of caudal. Dorsal and ventral adipose fins short; a low fold of skin in mid-ventral line in front of ventral adipose fin, but not continuous with it. Photophores in ventral series, I.-P. 10; P.-V. 16; V.-A. 21; A.-C. 11; in lateral series O.-V. 15; V.-A. 21. White spots on side of head as in *A. filifer*.

Caribbean Sea.

A single specimen taken at station 1266 with 800 metres of wire out. Length to base of caudal 145 mm.

Closely related to *A. filifer*, from which it is separated mainly by the larger eye. The fold of skin in front of the ventral adipose fin suggests that this may have been longer in the young fish. Perhaps this species is not distinct from *A. filifer*, but as a rule the eye does not increase its size with age in *Astronesthes*.

4. ASTRONESTHES CAULOPHORUS sp. n.

Depth of body $7^1/_3$ in length, length of head 4. Diameter of eye $4^1/_2$ in length of head. Post-ocular luminous organ well separated from eye. Barbel as long as head, stout, white, its tip not swollen, but

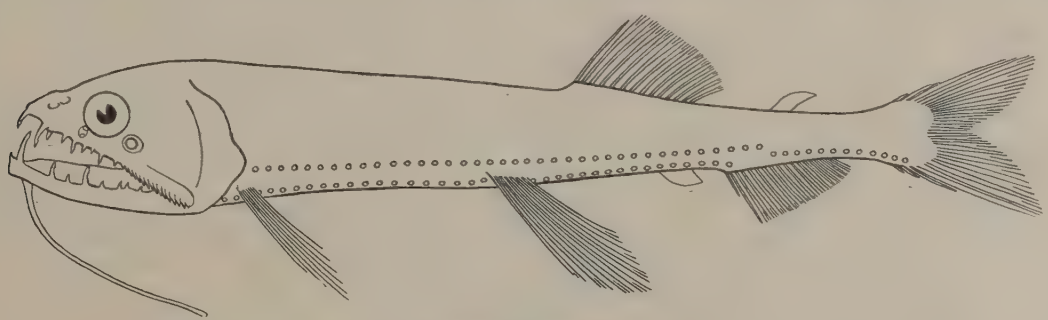

Fig. 3. *Astronesthes caulophorus* (× 4).

somewhat flattened, translucent, with opaque central core. 9 to 11 palatine teeth on each side. Dorsal 14, originating behind pelvics and ending well in front of anal; distance from snout to origin of dorsal exceeds that from snout to pelvics by about $8\,^0/_0$ of length without caudal. Anal 18. Pectoral 8. Pelvics 7-rayed, a little nearer to base of caudal than to end of snout. Dorsal and ventral adipose fins present. Photophores in ventral series I.-P. 11; P.-V. 18; V.-A. 18; A.-C. 12; in lateral series O.-V. 18; V.-A. 20.

N. Atlantic.

A single specimen, 34 mm. in length to base of caudal, taken at station 1162, with 300 metres of wire out.

5. ASTRONESTHES SIMILIS, Parr, 1927.

Astronesthes similus, Parr, Bull. Bingham Ocean. Coll. III. Art. 2, p. 32, figs. 22 and 23.

Depth of body $5^3/_4$ to $6^1/_2$ in length, length of head $4^1/_5$ to $4^1/_2$. Diameter of eye $4^1/_2$ to 5 in length of head, 2 to 3 times length of post-ocular luminous organ, which is very conspicuous and just

behind eye. Barbel 1 to $1^1/_3$ length of head, (shorter than head in 20 mm. specimens), black, ending in a white bulb bearing two slender filaments with slightly swollen tips. Palatine teeth weak, about 5 on each side. Dorsal 12—14, beginning a little behind pelvics and ending far in front of anal; distance from snout

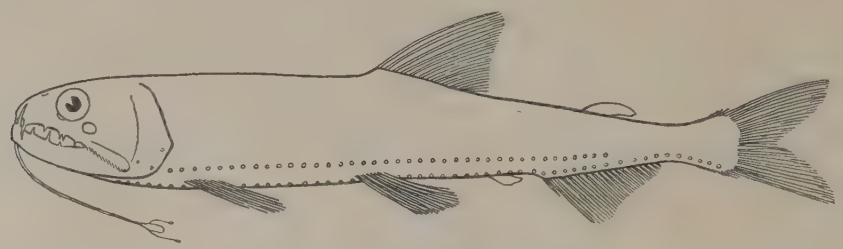

Fig. 4. *Astronesthes similis.* After PARR.

to dorsal exceeds that from snout to pelvics by 5 % or less of length without caudal. Anal 19—21. Pectoral 8. Pelvics 7-rayed, nearer to end of snout than to base of caudal. Dorsal adipose fin with a short base, ventral still smaller. Photophores in ventral series I.-P. 10—11; P.-V. 15—16; V.-A. 21—24; A.-C. 10—11; in lateral series P.-V. 15—17; V.-A. 23—25.

N. Atlantic; Caribbean Sea.

30 specimens 20 to 150 mm. in length to base of caudal, from stations 437, 939, 1031, 1063, 1072, 1183, 1184, 1186, 1195, 1214, 1217, 1223, 1228, 1229, 1250, 1253, 1272, 1278, 1279, 1281, 1282, 1293 and 1352, with 0 to 1500 metres of wire out.

6. ASTRONESTHES LUETKENI. sp. n.

Astronesthes richardsoni (*non* Poey) Lütken, Dansk. Vidensk. Selsk. Skrift. (6) VII, 1892, p. 273, pl. III, figs. 1—2.

Depth of body nearly 7 in length, length of head $4^1/_3$. Diameter of eye about 7 in length of head; postocular luminous orgen large, its length nearly equal to diameter of eye; barbel $1^1/_2$ length of

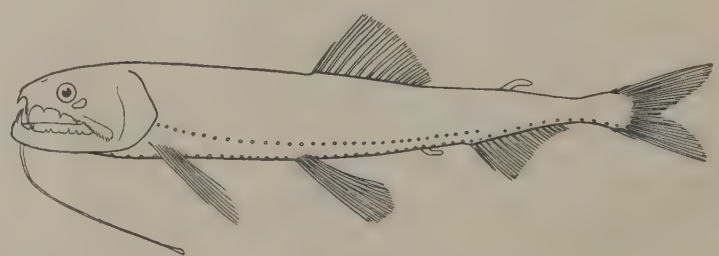

Fig. 5. *Astronesthes luetkeni.* After LÜTKEN.

head, ending in a long flattened bulb. Dorsal 13, originating immediately behind pelvics and ending well in front of anal. Anal 15. Pectoral 8. Pelvic 7. A very small ventral adipose fin. Photophores in ventral series: I.-P. 6; P.-V. 15; V.-A. ca. 20; A.-C. 10—11; in lateral series ca. 32.

Pacific Ocean.

Known from a single specimen, 95 mm. in length to base of caudal.

7. ASTRONESTHES RICHARDSONI, Poey, 1851.

Mem. Hist. Nat. Cuba, I. p. 176, pl. X, fig. 2.

Depth of body nearly 6 in the length, length of head $4^1/_3$. Diameter of eye $4^1/_2$ in length of head; barbel tapering, about $^3/_5$ length of head. Dorsal 12, originating a little behind pelvics and ending

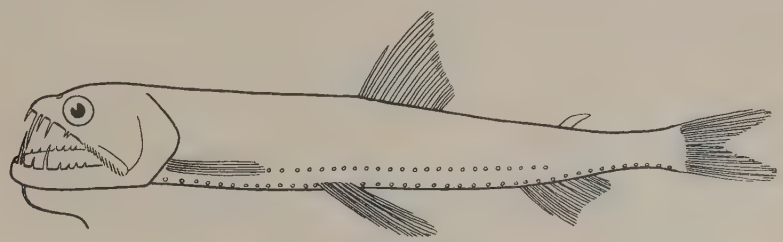

Fig. 6. *Astronesthes richardsoni.* After Poey.

far in front of anal. Anal 13. Pectoral 6. Pelvic 7. Cuba. Known from a single specimen 150 mm. in length. If the barbel be complete it is similar to that of *A. filifer*, but if not, the much larger eye distinguishes Poey's fish from the one described by Lütken as belonging to this species.

8. ASTRONESTHES MARTENSII, Klunzinger, 1871.

Verh. Zool. Bot. Ges. Wien, XXI, p. 154;
Lütken, Danske Vidensk. Selsk. Skrift. (6) VII, 1892, p. 276, Tab. III, figs. 6—7.

Depth of body 7 to $7^1/_4$ in length, length of head $4^1/_2$ to $4^3/_4$. Diameter of eye 4 to $4^1/_3$ in length of head. Post-ocular luminous organ fairly close to eye, and extending forwards below it. Barbel $1^1/_3$ length of head, slender, pigmented, ending in a small white elongate bulb without appendages. 11 or 12 palatine teeth on each side. Dorsal 11—12, originating a little behind pelvics and ending well in front of

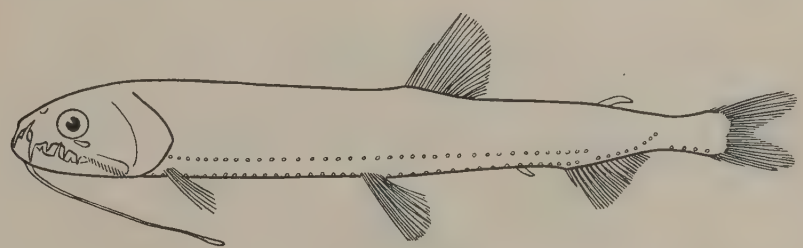

Fig. 7. *Astronesthes martensii.* After Lütken.

anal; distance from snout to dorsal exceeds that from snout to pelvics by about 6 to 7 % of length without caudal. Anal 19—22. Pectoral 6—7. Pelvics 7-rayed, a little nearer to end of snout than to base of caudal. Dorsal and ventral adipose fins short. Photophores in ventral series I.-P. 10—11; P.-V. 17—18; V.-A. 18—20; A.-C. 12—13, of which 7th and 8th, and in the type 9th also, are at a higher level than the others; in lateral series O.-V. 17; V.-A. 20.

Red Sea.

Known from specimens 115 to 150 mm. in total length, collected by Klunzinger, one of which is in the British Museum (Natural History).

9. ASTRONESTHES LUCIFER, Gilbert, 1905.

Bull. U. S. Fish. Comm. XXIII. p. 605, pl. LXXI, fig. 3; Weber and Beaufort, Fish. Indo-Austral. Archipelago, II, p. 116, fig. 42 (1913).

Depth of body $6^1/_3$ to $7^1/_3$ in length, length of head $4^1/_2$ to $5^1/_4$. Diameter of eye 5 to $5^1/_2$ in length of head. Post-ocular luminous organ close to eye. Barbel nearly $1^1/_2$ head, with small white terminal bulb. Dorsal 11—13, originating a little behind pelvics, and ending well in front of anal; distance

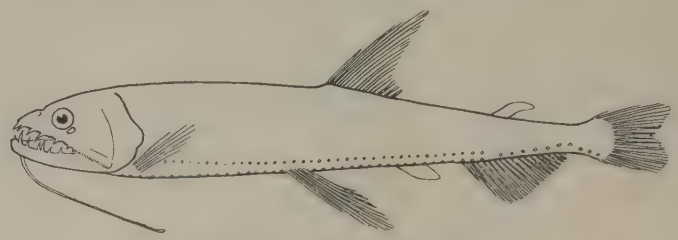

Fig. 8. *Astronesthes lucifer.* After Gilbert.

from snout to dorsal exceeds that from snout to pelvics by 3 to 6% of length without caudal. Anal 19—20. Pectoral 6. Pelvics 7-rayed, a little nearer end of snout than base of caudal. Dorsal and ventral adipose fins short. Photophores in ventral series I.-P. 10—12; P.-V. 18—20; V.-A. 21—24; A.-C. 10—12, the 6th and 7th, or 7th and 8th, higher than the others; in lateral series O.-V. 17—19; V.-A. 21—24.

Hawaii; Japan; Timor Sea.

Here described from 16 specimens, 74 to 88 mm. in length to base of caudal, from Japan. Weber and Beaufort's specimen, 75 mm. long, seems to belong to this species, but has the barbel only $^3/_5$ length of head.

10. ASTRONESTHES IJIMAI, Tanaka, 1908.

Journ. Coll. Sci. Tokyo, XXIII, 13, p. 9, pl. I, fig. 1.

Near *A. lucifer*, but head shorter ($5^1/_5$ to $5^3/_4$ in length), barbel longer ($1^2/_3$ to $1^5/_6$ head), and anal fin with fewer rays. D. 10—11. A. 12—16. P. 5—6. Pv. 6—7. Photophores as in *A. lucifer*.

Japan.

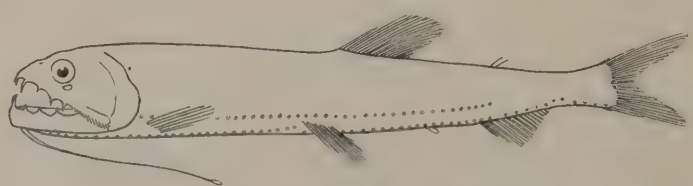

Fig. 9. *Astronesthes ijimai.* After Tanaka.

11. ASTRONESTHES CHRYSOPHEKADION, Bleek. 1849.

Stomianodon chrysophekadion, Bleek. Verh. Bat. Gen. XXII, 1849, Bijds. Ichth. p. 10.

Astronesthes chrysophekadion, Bleek. Atl. Ichth. VI, p. 150, pl. CCLXXVIII, fig. 1 (1875); Weber and Beaufort, Fish. Indo-Austral. Arch. II, p. 117 (1913).

Fig. 10. *Astronesthes chrysophekadion.* After Bleeker.

Probably related to *A. martensii*, etc. but distinguished by the large eye, 1/3 length of head in a specimen of 115 mm. Barbel a little shorter than head. Dorsal 12; originating a little behind pelvics. Anal 20. P. 6. Pv. 7.

Bali.

12. ASTRONESTHES GEMMIFER. Goode and Bean, 1895.

(Pl. I, fig. 3).

Oceanic Ichthyology, p. 105, fig. 124.

Jordan and Everman, Bull. U. S. Nat. Mus. XLVII, 1896, p. 586, pl. XCIII, fig. 251. Parr, Bull. Bingham Ocean. Coll., III, Art. 2, 1927, p. 30.

Depth of body 5 1/2 to 6 in length, length of head 3 1/4 to 4 1/2. Diameter of eye 4 to 5 in length of head. Post-ocular luminous organ very small, close to eye. Barbel from a little longer than to 1 1/2 length of head, white, ending in an elongate, slightly curved bulb, the distal half of which is black on the convex side. 4 (young) to 9 palatine teeth on each side. A double series of minute teeth along basibranchials. Dorsal 15—17, originating above posterior end of base of pelvics and ending in front of anal. Anal 16—19. Pectoral 8—9. Pelvics 7-rayed, nearer to end of snout than to base of caudal. Adipose dorsal short; ventral adipose fin small. Photophores in ventral series I.-P. 10—12; P.-V. 17—19; V.-A. 27—28; A.-C. 9—11; in lateral series P.-V. 17—19; V.-A. 27—28.

Atlantic; Caribbean Sea.

Three specimens, one 160 mm. in length without caudal, from Station 1183 (3500 M. W.), one of 40 mm. from St. 1342 (3000 M. W.), and one of 22 mm. from St. 1163 (300 M. W.). One in the British Museum (Natural History) from off Sierra Leone ("Challenger" St. 101) is 34 mm long.

The type, until now the only example known, of nearly the same size as the largest "Dana" specimen, was taken from the stomach of a halibut in 44° 25′ N. 53° 12′ W.

13. ASTRONESTHES CYCLOPHOTUS sp. n.

Depth of body 4 to 5 in length, length of head 3 1/8 to 3 1/2. Diameter of eye 5 to 5 1/2 in length of head, 1 1/2 in length of snout. Post-ocular luminous organ circular, behind eye and well separated from it. Barbel 2/3 to as long as head, black, with white distal part flattened into a delicate, narrow, leaf-like

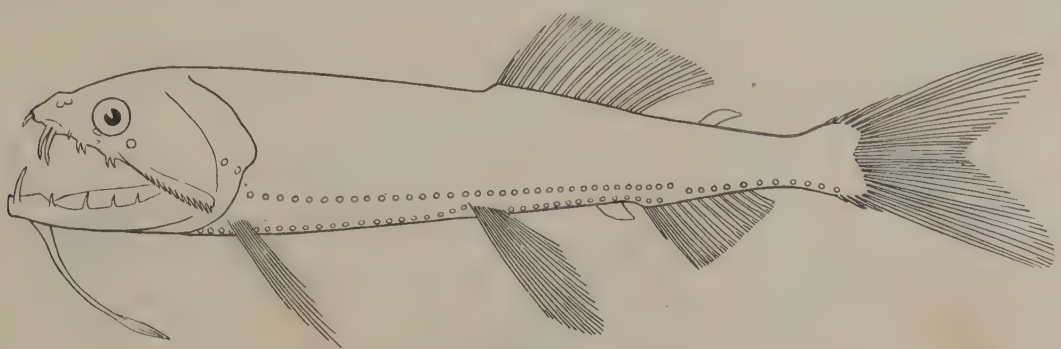

Fig. 11. *Astronesthes cyclophotus* (× 5).

structure, tapering to a point and with opaque axis. 4 to 6 palatine teeth on each side. Dorsal 15—16, originating above base of pelvics and ending above or immediately in front of first anal ray. Anal 12—15. Pectoral 8—9. Pelvic 7, nearer to base of caudal than to end of snout. Small dorsal and ventral adipose fins. Photophores in ventral series, I.-P. 9—10; P.-V. 17—19; V.-A. 17—18; A.-C. 11—12; in lateral series P.-V. 16—18; V.-A. 18—19.

N. Atlantic.

5 specimens 20 to 28 mm. in length to base of caudal, taken at stations 1042, 1058, 1153, and 1155 with 80 to 300 metres of wire out.

A damaged specimen 26 mm. long, taken at station 1148 with 500 metres of wire out, may also be referred to this species.

14. ASTRONESTHES NEOPOGON sp. n.

(Pl. II, fig. 1).

Depth of body 7 in length, length of head $4^1/_2$. Diameter of eye 5 in length of head. Post-ocular luminous organ very small, well separated from eye. Barbel $^2/_5$ length of head, thick, laterally compressed, white, without any slender proximal part. Palatine teeth rather strong, 8 on each side. Dorsal 17, originating a little behind pelvics and ending not far in front of anal. Anal 15. Pectoral 9, about $^3/_4$ length of head. Pelvics 7-rayed, equi-distant from end of snout and base of caudal. An adipose dorsal and a small adipose ventral. Photophores in ventral series, I.-P. 10; P.-V. 18—19; V.-A. 17—18; A.-C. 11; in lateral series, P.-V. 17; V.-A. 19. Small luminous dots all over body, and larger spots, some forming an irregular series from pectoral to pelvics, others a lateral band backwards from operculum, and others scattered on the back.

N. Atlantic.

A single specimen, 125 mm. in length to base of caudal, from Station 1368 with 1000 metres of wire out.

15. ASTRONESTHES NIGER, Richards., 1845.

Astronesthes nigra, Richardson, Voy. "Sulphur", Ichth. p. 97, pl. L, figs. 1—3.

?*Stomias leucopterus*, Eydoux and Souleyet, Voy. "La Bonite", Zool. p. 193, pl. VII, fig. 4 (1841).

?*Stomias fieldii*, Cuv. et Val., Hist. Nat. Poiss. XVIII, p. 280 (1846).

?*Chauliodus fieldii*,[1] Cuv. et Val., o. c. XXII, p. 390 (1894).

?*Phaenodon ringens*, Lowe, Proc. Zool. Soc. 1850, p. 250.

Astronesthes barbatus, Kner, Sitzb. Akad. Wien, XXXIX, 1860, p. 543, fig. 5.

Astronesthes niger, Günth., Cat. Fish. V, p. 425 (1864); Lütken, Dansk. Vidensk. Selsk. Skrift. (6) VII, 1892, p. 273, pl. III, figs. 3—5; Goode & Bean, Oceanic Ichthyology, p. 105, fig. 123 (1895)[1] Parr, Bull. Bingham Ocean. Coll. III, Art. 2, 1927, p. 36.

Astronesthes myriaster,[2] Zugmayer, Bull. Inst. Ocean. Monaco, No. 253, 1913, p. 4.

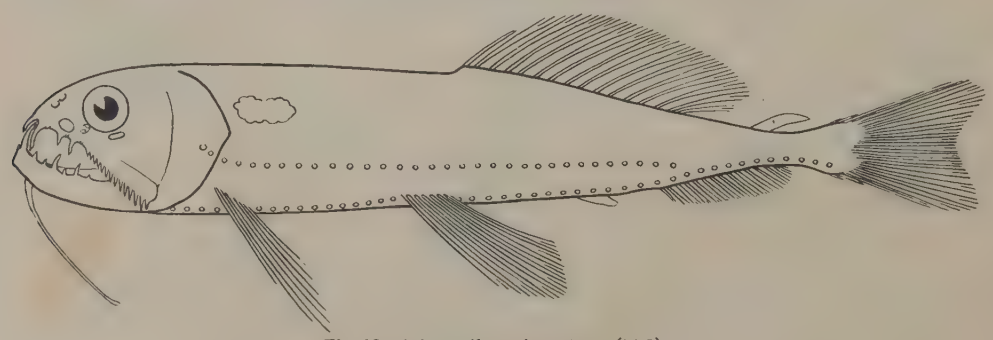

Fig. 12. *Astronesthes niger*, type (× 2).

[1] Goode and Bean's figure is of the type of *A. fieldii*, 150 mm. long to base of caudal; it shows no luminous patch on shoulder, and dorsal fin beginning somewhat farther back than in any specimens we have seen.

[2] We are indebted to Prof. Roule for the loan of the type of *Astronesthes myriaster*, 31 mm. in length to base of caudal. It is an undoubted *A. niger*. D. 16; A. 14; Photophores in ventral series I.-P. 9; P.-V. 14; V.-A. 19; A.-C. 11; in lateral series P.-V. 14; V.-A. 20.

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Depth of body $4^1/_2$ to $5^1/_2$ in length, length of head 4 to $4^1/_3$. Diameter of eye $4^1/_2$ to 5 in length of head, equal to or a little less than length of snout. Post-ocular luminous organ close to orbit, extending forwards under eye. Barbel from $^2/_3$ to a little longer than head, white or lightly pigmented, ending in an elongate bulb, which is relatively smaller in larger fish. (In post-larval fishes identified with this species by numbers of photophores and fin rays the barbel is shorter, sometimes a mere stump, and has no bulb.) 4 to 6 rather weak palatine teeth on each side. Dorsal 14—18, originating a short distance behind pelvics and ending above 1st to 6th, rarely 7th anal ray. Anal 13—15. Pectoral 8. Pelvics 7-rayed, a little nearer to end of snout than to base of caudal. Small dorsal and ventral adipose fins. Photophores in ventral series I.-P. 8—10; P.-V. 12—14; V.-A. 18—21. Smaller luminous spots often more conspicuous than photophores of main series and nearly as large, especially in two ventral longitudinal rows from isthmus to tail. Glandular white patches, probably luminous, on the head, a large one between the eye and praemaxilla being specially constant, and, in older fishes, one on the upper part of the body close behind the gill-openings.

Atlantic. Caribbean Sea.

40 specimens 18 to 46 mm. in length to base of caudal, and 13 post-larvae, 12—20 mm. long which have been referred to this species on numerical characters, from stations 400, 414, 445, 446, 451, 454, 501, 516, 645, 878, 887, 1044, 1056, 1058, 1158, 1159, 1160, 1161, 1165, 1181, 1183, 1186, 1189, 1194, 1216, 1217, 1245, 1322, 1342, 1372 and 1378, with 0 to 3000 metres of wire out.

The type, in the collection of the British Museum (Natural History) measures 63 mm. to base of caudal.

16. ASTRONESTHES BOULENGERI, Gilchrist, 1904.

Mar. Inv. S. Africa, II, p. 103, pl. VI.

Depth of body 6 in length, length of head $4^1/_2$. Diameter of eye $4^1/_2$ in length of head. Post-ocular luminous organ very small, below eye. Barbel at least $^1/_2$ length of head (probably broken in type). Dorsal 16; originating a little behind pelvics and ending immediately in front of anal. Anal 15. Pectoral 8. Pelvics 7-rayed, a little nearer to tip of snout than to base of caudal. Small dorsal and ventral adipose fins. Photophores in ventral series I.-P. 7; P.-V. 14; V.-A. and A.-C. 35; in lateral series 35. Minute lumi-

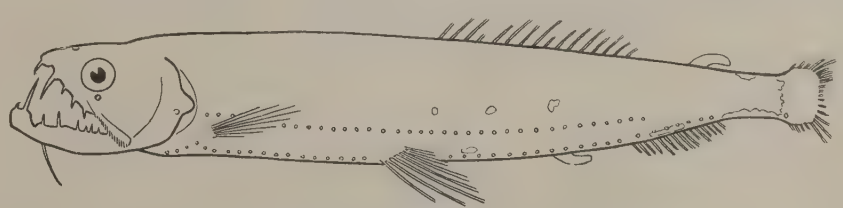


Fig. 13. *Astronesthes boulengeri.* After Gilchrist.

nous spots scattered over head and body and forming two rows on ventral surface. Glandular patches, pinkish when fresh, white in spirit, on the sides of the body behind the pelvic region, and above and below on caudal peduncle.

Known from a single specimen 213 mm. long, from South Africa (depth 360 fathoms).

This species is very close to *A. niger*, but the type is much larger than any recorded specimens of that species, except the doubtful *Phaenodon ringens*, Lowe.

17. ASTRONESTHES CYANEUS, A. Brauer, 1902.

Bathylychnus cyaneus, Brauer, "Valdivia" Tiefseefische. p. 35, text-fig. 6, pl. II, fig. 5 (1906).

Depth of body 5—$6^1/_4$ in length, length of head $3^3/_4$—4. Diameter of eye 4—$4^2/_3$ in length of head, about equal to snout. Post-ocular luminous organ small, close to eye, and extending forwards below

it. Barbel slender, white, about 1/2 length of head; in adult fishes, when complete, ending in a very small, elongate bulb. Palatine teeth weak, 4—6 on each side. Dorsal 18—21, originating just behind pelvics and ending above 3rd—9th anal ray. Anal 14—15. Pectoral 8, or, rarely, 7. Pelvics 7-rayed, nearer to end of snout than to base of caudal. A small adipose dorsal, and a ventral adipose fin. Photophores in ventral series I.-P. 9—10; P.-V. 12—15; V.-A. 17—19; A.-C. 9—12; in lateral series O.-V. 13—14; V.-A. 18—21.

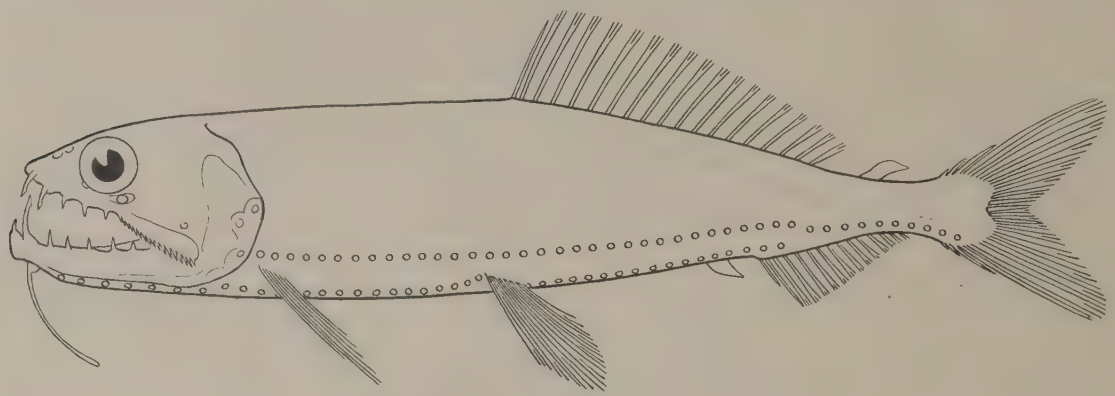


Fig 14. *Astronesthes cyaneus* (× 2).

Small luminous dots much less conspicuous than in *A. niger*. White or yellowish patches of glandular tissue sometimes present on head and, very characteristically, on lower part of operculum. Sides of head and body with metallic, steely or bronze-like lustre, often showing blue irridescence.

Atlantic; Caribbean Sea; Indian Ocean.

62 specimens, 15 to 76 mm. in length to base of caudal, from stations 654, 722, 831, 935, 949, 1155, 1160, 1182, 1186, 1194, 1198, 1202, 1214, 1216, 1217, 1225, 1242, 1245, 1247, 1250, 1253, 1257, 1260, 1269, 1273, 1278, 1281, 1289, 1291, 1292, 1293, 1310, and 1314, with 19 to 3500 metres of wire out; and 7 doubtful post-larvae.

Dr. P. Pappenheim has kindly re-examined the type, in which the barbel has been broken off, but a stump remains, and a small postocular luminous organ is present.

18. ASTRONESTHES LEUCOPOGON, sp. n.

(Pl. II, fig. 2).

Depth of body 5 1/4 to 5 1/2 in length, length of head 4 to 4 3/5. Diameter of eye 4 to 5 in length of head, equal to or a little greater than length of snout. Post-ocular luminous organ close to eye, extending forwards below it. Barbel 1 1/8 to 1 1/4 length of head, white, tapering somewhat to a blunt end. 5 or 6 palatine teeth on each side. Dorsal 17—18, originating above or just behind base of pelvics and ending above 2nd to 4th anal ray. Anal 17. Pectoral 8. Pelvic 7—8, a little nearer to end of snout than to base of caudal. A small ventral adipose fin, and a short adipose dorsal. Photophores in ventral series I.-P. 9—10; P.-V. 10—11; V.-A. 14—15; A.-C. 11—12; in lateral series O.-V. 10—12; V.-A. 18—19. Smaller photophores conspicuous as in *A. niger*, especially in two rows along ventral surface. Glandular, white patches, probably luminous, present, in the two larger specimens, on the head (notably between eye and praemaxilla), on the sides of the body behind the pelvics, above the ventral adipose fin and, in the 45 mm. specimen, in front of the pelvics and above the pectorals.

N. Atlantic.

Described from 3 specimens, two, 45 and 40 mm. respectively in length to base of caudal, collected by the "St. Thomas" in 1912 at station 445 (30° 50′ N. 44° 30′ W.), and one, 24 mm. long, from the Dana station 1142, with 300 metres of wire out.

This species is near to *A. niger*, from which it differs in photophore numbers, structure of barbel, and distribution of white luminous patches on the body.

A fish 39 mm. in length to base of caudal, in the collection of the British Museum (93-2-18-8) may also be referred to this species. It was taken in mid-Atlantic.

19. ASTRONESTHES LONGICEPS, sp. n.

Very near *A. leucopogon*, but with longer head and shorter anal fin. Depth $4^{2}/_{3}$ in length, length of head $3^{1}/_{5}$. Diameter of eye $5^{1}/_{2}$ in length of head. Barbel a little longer than head. 7 palatine teeth

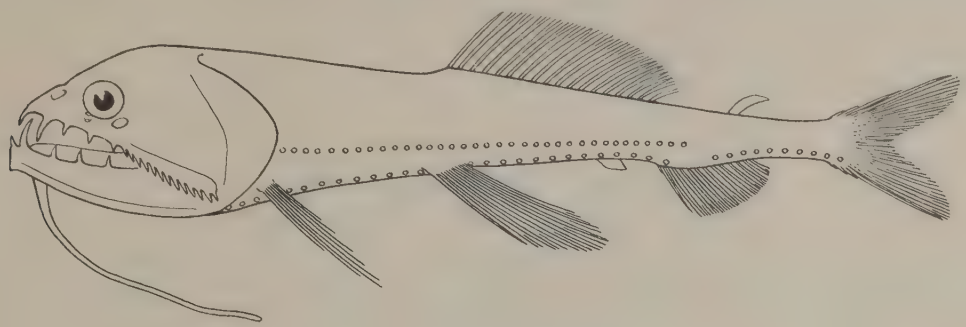


Fig. 15. *Astronesthes longiceps* (× 5).

on each side. Dorsal 18. Anal 13. Pectoral 8. Pelvic 7. Photophores in ventral series I.-P. 9; P.-V. 10; V.-A. 13; A.-C. 10; in lateral series O.-V. 13; V.-A. 21.

Atlantic.

A single specimen, 25 mm. long to base of caudal, from station 1058 (29° 24′ N. 48° 08′ W.), with 10 metres of wire out.

20. ASTRONESTHES INDICUS, A. Brauer, 1902.

(Pl. II, fig. 3).

Zool. Anz. XXV, p. 287, and "Valdivia" Tiefseefische, p. 33 text-fig. 5, Pl. II, fig. 3, (1906).

Astronesthes sp. Alcock, Cat. Indian Deep-Sea Fishes p. 211 and Ill. Zool. "Investigator", Pl. XXXV, fig. 3. (1899).

Depth of body $4^{1}/_{2}$ to $5^{1}/_{2}$ in length, length of head $3^{1}/_{2}$ to $4^{1}/_{4}$. Diameter of eye 4 to 5 in length of head. Post-ocular organ elongated, extending forwards to below pupil. Barbel $^{1}/_{2}$ to $1^{1}/_{2}$ length of head; in fishes up to 75 mm. once to $1^{1}/_{2}$ head, white or very ligthly pigmented, of almost uniform thickness for the proximal $^{3}/_{4}$ of its length, then somewhat thicker and slightly laterally compressed, and near the end strongly flattened in the other direction, this terminal part being translucent with opaque axis. In larger fish barbel $^{1}/_{2}$ length of head, pigmented, tapering almost to the tip, ending in a minute white bulb with a pigmented strip on each side meeting over the tip. Palatine teeth rather strong, directed backwards, forming a relatively close series, 8 to 12 on each side. Dorsal 15—16, originating above or a little behind base of pelvics and ending above 1st to 7th anal ray. Anal 14—16, usually 14. Pectoral 7—8. Pelvics 7-rayed, equidistant from end of snout and base of caudal. Photophores in ventral series I.-P. 5; P.-V. 5—6; V.-A. 8—9; A.-C. 7—9; in lateral series O.-V. 6; V.-A. 6—8. Large white patches of luminous tissue present on the sides of the body in adults, in definite positions near dorsal and ventral ends of operculum, behind and a little above base of pectoral, one in front of pelvic fin, and two, a lateral and a dorsal, above it.

Atlantic; Caribbean Sea; Indian Ocean.

53 specimens, 11 to 103 mm. in length to base of caudal, from stations 830, 831, 926, 950, 952, 1066, 1072, 1153, 1155, 1158, 1159, 1163, 1165, 1166, 1171, 1185, 1194, 1195, 1261, 1267, 1270, 1274, 1276, 1292, 1294, 1296, 1310, and 1314, with 50 to 6000 metres of wire out.

In the largest fish (103 mm.). the barbel (13 mm. long) is incomplete, and it is not improbable that the lesser length and different structure of the barbel in the 85—88 mm. specimens, as compared with smaller ones, is due to breakage and regeneration, although its similar length and structure in these two specimens is against this view, and points to shortening of the barbel in older fish. In two specimens 54 mm. to base of caudal the barbel is 20 mm. long, in two of 62 and 75 mm. the barbel is 19 mm. long, whereas in the two of 85 and 88 mm. the barbel measures 11 and 11.5 mm. respectively.

The patches of luminous tissue are all preseut in the three largest fish (85—103 mm.); in specimens of 30 mm. only the opercular patches are present. The patches above the pectoral and in front of the pelvic fins are the last to develop.

2. **BOROSTOMIAS**, Regan, 1908.

Trans. Linn. Soc. XII, p. 217.

Cleft of mouth straight. Praemaxillaires and lower jaw with strong fangs. Maxillary teeth few (7—10), set well apart, rather strong, erect and incurved, some or all straight and slightly barbed at the end, like the fangs of the praemaxillaires and lower jaw. Generally a pair of teeth on the vomer; a series of teeth on each palatine. Short strong teeth on the gill-arches; none on cerato-hyal. Postocular luminous organ single. Dorsal fin of 11 to 16 rays, originating above or just behind pelvics and not extending to above anal, which has 10 to 18 rays. Post-temporal long, slender. Stomach large.

Atlantic; Indian Ocean; Gulf of Panama.

Synopsis of the Species.

I. D. 11. A. 10. Vent midway between pelvics and anal fin	1. *abyssorum*
II. D. 11. A. 14. Vent near anal fin	
Diameter of eye 4 in length of head	2. *macrophthalmus*
Diameter of eye $5^2/_3$ in length of head	3. *antarcticus*
III. D. 13—14. A. 14—16.	
Barbel a little shorter than head; postocular luminous organ as long as eye	4. *schmidti*
Barbel $1^1/_3$ to $1^1/_2$ head, slender, with slightly thickened white terminal part $^1/_{20}$ length of head; postocular luminous organ shorter than eye, which is 8 in length of head	5. *braueri*
Barbel $1^1/_2$ head; eye $6^2/_5$ in length of head	6. *elucens*
IV. D. 14. A. 18. Barbel $1^2/_5$ head, ending in a slightly thickened white part $^1/_{10}$ length of head, with a filament	7. *panamensis*
V. D. 16. A. 17. Barbel $1^1/_2$ head, ending in a small white bulb with two filaments	8. *macristius*

1. BOROSTOMIAS ABYSSORUM, Koehler, 1896.

Astronesthes abyssorum, Koehler, Ann. Univ. Lyon, Paris, Fasc. 26, p. 511, Pl. XXVII, fig. 10.

Depth of body $7^1/_2$ in length, length of head $4^1/_3$. Snout 4 in length of head, diameter of eye $4^1/_2$. Post-ocular luminous organ large. Barbel a little less than $^3/_4$ length of head, with a well-marked

swelling a little before the tip; the part distal to this swelling unpigmented. Maxillary with about 6 large teeth. Dorsal 11; originating above base of pelvics. Anal 10. Pectorals short, 5-rayed. Pelvics 7-rayed, shorter than pectorals, nearer to base of caudal than to snout. Anus equidistant from pelvics and anal fin. Photophores not determined.

Known from a single specimen, 75 mm. in total length, from of the Atlantic coast of France.

Fig. 16. *Borostomias abyssorum.* After KOEHLER.

2. BOROSTOMIAS MACROPHTHALMUS, sp. n.

Astronesthes richardsonii (*non* Poey) GOODE and BEAN, Oceanic Ichthyology, p. 106, fig. 125 (1895); JORDAN & EVERMAN, Bull. U. S. Nat. Mus., XLVII, pt. IV, pl. XCIV, fig. 262 (1900).

Astronesthes elucens (*non* Brauer) PARR, Bull. Bingham Ocean. Coll. vol. III, Art. 2, 1927, p. 28, fig. 20.

? *Borostomias richardsonii,* Barnard, Ann. S. Afr. Mus. XXI, 1925, p. 135.

Depth of body about 7 in length, length of head $4^2/_3$. Snout $^2/_3$ diameter of eye, which is 4 in length of head. Post-ocular luminous organ half diameter of eye. Barbel a little shorter than head, with an elongated white terminal portion dilated at the tip. 7 or 8 maxillary teeth. Dorsal 11; originating

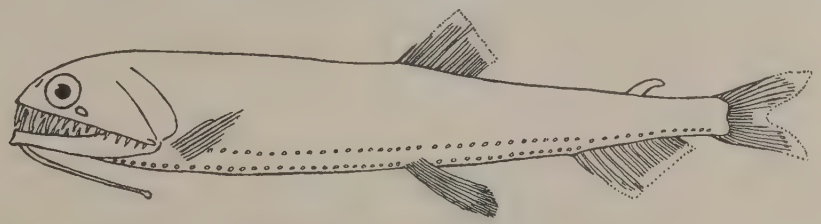


Fig. 17. *Borostomias macrophthalmus.* After GOODE and BEAN.

above pelvics. Anal 14—15. Pectoral 9. Pelvics 7-rayed, nearer to base of caudal than to snout. A small ventral adipose fin present (*fide* PARR). Photophores in ventral series I.-P. *ca.* 11; P.-V. *ca.* 23; V.-A. *ca.* 15; A.-C. 14.

Known from a single specimen, 168 mm. in length to base of caudal, collected by the "Albatross" at 39° 38′ N. 71° 39′45″ W. in 515 fathoms.

3. BOROSTOMIAS ANTARCTICUS, Lönnberg, 1905.

Astronesthes antarcticus, Lönnberg, Zool. Anz. XXVIII, 1905, p. 762, and Fishes of the Swedish South Polar Expedition, p. 65 (1905).

Depth of body $5^2/_3$ in length, length of head 5. Diameter of eye $5^2/_3$, snout $3^2/_3$ in length of head. Maxillary with 7 teeth[1]. Barbel a little longer than head, with an unpigmented, somewhat club-shaped, luminous organ at the end. Dorsal 11; originating above pelvics. Anal 15. Pectoral 9. Pelvics 7; nearer to base of caudal than to snout. Photophores in ventral series I.-V. 35; V.-A. 19 (?); in lateral series O.-C. about 56. Type 188 mm. long to base of caudal, from the South Atlantic Ocean (48° 27′ S. 42° 36′ W.); depth 2,500 metres.

[1] We are indebted to Prof. LÖNNBERG for information concerning the maxillary teeth.

4. BOROSTOMIAS SCHMIDTI, sp. n.

(Pl. III, fig. 1).

Depth of body 5 in length, length of head $4^{3}/_{4}$. Diameter of eye $6^{1}/_{2}$ in length of head, equal to length of post-ocular luminous organ. Barbel a little shorter than head, with a rather long, white, terminal portion, not enlarged, separated from the black stem by a transparent region with a narrow, dark stalk in the middle. Maxillary with 8 to 10 teeth. Dorsal 13; originating just behind pelvics. Anal 16. Pectoral 7. Pelvics 7-rayed, nearer to base of caudal than to snout. Photophores in ventral series I.-P. 10; P.-V. 22; V.-A. 15; A.-C. 5+8; in lateral series O.-V. 21; V.-A. 15.

N. Atlantic.

One specimen, 185 mm. in length to base of caudal, from station 1159, with 300 metres of wire out.

Named in honour of Dr. JOHANNES SCHMIDT, leader of the "Dana" Expedition.

5. BOROSTOMIAS BRAUERI, Regan, 1908.

(Pl. III, fig. 2).

Trans. Linn. Soc. XII, p. 217, pl. XXIII, fig. 1.

Depth of body 5 to $5^{1}/_{2}$ in length, length of head 4 to $4^{1}/_{2}$. Diameter of eye less than length of snout, 8 in length of head, $1^{1}/_{2}$ as long as post-ocular luminous organ. Lower jaw $^{9}/_{10}$ length of head. 8 to 10 maxillary teeth. Barbel $1^{1}/_{3}$ to $1^{1}/_{2}$ length of head, slender, with slightly thickened terminal white portion about $^{1}/_{20}$ length of head. Dorsal 13—14, originating above or just behind pelvics, and ending well in front of anal. Anal 14—16. Pectoral 7. Pelvics 7-rayed, nearer to base of caudal than to end of snout. Photophores in ventral series I.-P. 10—12; P.-V. 22—24; V.-A. 15—16; A.-C. 13 (5+8); in lateral series O.-V. 22; V.-A. 15—16.

Atlantic; Caribbean Sea; Indian Ocean.

Two specimens, 75 and 175 mm. in length to base of caudal, from stations 1165 and 1217, with 2000 to 3000 metres of wire out. These have been compared with the type (110 mm.) from the Indian Ocean. A third specimen, 50 mm. long (St. 1165, 5000 M.W.) seems to belong to this species.

6. BOROSTOMIAS ELUCENS, A. Brauer, 1906.

"Valdivia" Tiefseefische, p. 31.

Apparently distinguished from *B. braueri* by the larger eye, longer than snout and $6^{2}/_{5}$ in length of head. Barbel $1^{1}/_{2}$ head. D. 14; A. 16; P. 7; Pv. 7. Photophores in ventral series I.-P. 10; P.-V. 23; V.-A. 14; A.-C. 14.

Gulf of Guinea.

Known from a single specimen, 146 mm, in length to base of caudal.

7. BOROSTOMIAS PANAMENSIS, sp. n.

(Pl. IV, fig. 1).

Depth of body 6 in length, length of head 5. Diameter of eye 8 in length of head, nearly twice as long as post-ocular luminous organ. Lower jaw $^{6}/_{7}$ length of head. 9 maxillary teeth. Barbel $1^{2}/_{5}$ length of head, stouter than in *B. braueri*, black, ending in a white portion slightly thicker than the stem, and $^{1}/_{10}$ the length of head, with a filament near its end. Dorsal 14, originating just behind pelvics, and ending well in front of anal. Anal 18. Pectoral 7. Pelvics 7-rayed, nearer to base of caudal than to end of snout.

Photophores in ventral series I.-P. 11; P.-V. 23; V.-A. 17; A.-C. 12 (5+7); in lateral series O.-V. 22; V.-A. 17.

Gulf of Panama.

A single specimen, 208 mm. in length to base of caudal, from Station 1208, with 3600 metres of wire out.

Compared with specimens of *B. braueri* from the Atlantic this is a more slender fish, with shorter head, with the praeoperculum meeting the maxillary at a less acute angle and the lower jaw shorter, with stouter barbel with longer white terminal part bearing a filament, and with a longer anal fin.

8. BOROSTOMIAS MACRISTIUS, sp. n.

(Pl. IV, fig. 2).

Depth of body $6^1/_2$ in length, length of head $4^3/_4$. Diameter of eye $6^1/_2$ in length of head, twice as long as post-ocular luminous organ. Barbel $1^1/_2$ length of head, ending in a small white bulb, with two slender filaments arising from its base; distal portion of black part not swollen, but bearing a pair

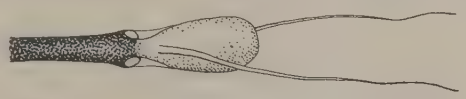


Fig. 18. *Borostomias macristius.* End of barbel, anterior view.

of small luminous organs as in *Diplolychnus.* Dorsal 16, high, originating above pelvics and ending a little in front of anal. Anal 17. Pectoral 8. Pelvics 7-rayed, in middle of length. Photophores in ventral series I.-P. 11; P.-V. 20; V.-A. 15; A.-C. 12 (5+7); in lateral series O.-V. 21; V.-A. 15.

Gulf of Panama.

One specimen, 155 mm. in length to base of caudal, from Station 1206, with 3000 metres of wire out.

3. DIPLOLYCHNUS, gen. nov.

Cleft of mouth straight. Fangs moderate; maxillary teeth erect, curved forwards, 12 to 16 in adults; teeth on gill-arches well developed. Post-ocular organ with two luminous surfaces, a larger behind

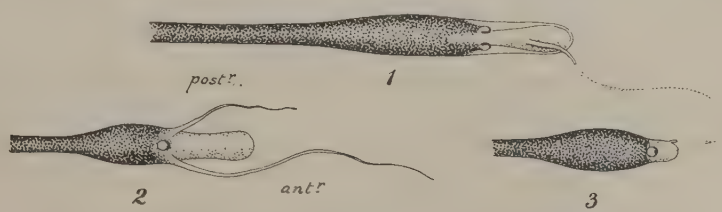


Fig. 19. *Diplolychnus.* Ends of barbels. 1. *D. mononema,* anterior view. 2. *D. bifilis,* lateral view. 3. *D. lucifer,* lateral view.

and a smaller below the eye, the two sometimes connected by a slender strip. Post-temporal replaced by a strong ligament. Stomach large.

Three species from the Atlantic.

Synopsis of the species.

Posterior part of post-ocular luminous organ as long as eye. Barbel $^1/_2$ length of head, with one filament near end ..... 1. *lucifer*

Posterior part of post-ocular luminous organ about $^1/_2$ diameter of eye. Barbel as long as head, with one filament near end ..... 2. *mononema*

Posterior part of post-ocular luminous organ about $^1/_2$ diameter of eye. Barbel a little more than $^1/_2$ length of head, with two filaments near end ..... 3. *bifilis*

1. DIPLOLYCHNUS LUCIFER, sp. n.

(Pl. V, fig. 1).

Depth of body $6^2/_3$ in length, length of head nearly 6. Diameter of eye $6^1/_3$ in length of head, about equal to length of post-ocular part of luminous organ. Barbel about $^1/_2$ length of head, the black stem ending in a swollen part, bearing a pair of minute luminous bodies, and followed by a very small white tip about $^1/_3$ length of black swollen part, with a single very short filament near its end. Dorsal 14; beginning a little behind pelvics and ending far in front of anal. Anal 16. Pectoral 7. Pelvics 7-rayed, equidistant from tip of snout and base of caudal. Photophores in ventral series I.-P. 10; P.-V. 25; V.-A. 25; A.-C. 12; in lateral series O.-V. 22; V.-A. 25. A small oblong luminous patch just behind the praeoperculum.

Atlantic.

A single specimen 245 mm. in length to base of caudal, from station 1156, with 1000 metres of wire out.

2. DIPLOLYCHNUS MONONEMA, sp. n.

(Pl. V, fig. 2).

Depth of body 6 in length, length of head $4^3/_4$ to $5^2/_3$. Diameter of eye 5 to 7 in length of head, twice length of post-ocular part of luminous organ. Barbel about as long as head, in structure like that of *D. lucifer*, except that the white tip is longer, about equal in length to the black swollen part. Dorsal 13; originating a little behind pelvics and ending far in front of anal. Anal 16—17. Pectoral 7. Pelvics 7-rayed, nearly equidistant from tip of snout and base of caudal. Photophores in ventral series I.-P. 10—11; P.-V. 25—26; V.-A. 22—25; A.-C. 12; in lateral series O.-V. 22—25; V.-A. 23—24. A small oblong luminous patch just behind the praeoperculum.

Atlantic.

Two specimens, 255 and 85 mm. in length to base of caudal, respectively from stations 1279 and 1281, with 1000 metres of wire out.

3. DIPLOLYCHNUS BIFILIS, sp. n.

(Pl. V, fig. 3).

Depth of body 7 in length, length of head $4^1/_2$. Diameter of eye 5 in length of head, twice length of post-ocular part of luminous organ. Barbel a little more than $^1/_2$ length of head, similar to that of *D. mononema*, but with two filaments instead of one. Dorsal 12, originating above or immediately behind base of pelvics. Anal 14—15. Pectoral 7. Pelvics 7-rayed, equidistant from eye and base of caudal. Photophores in ventral series I.-P. 9—11; P.-V. 22—24; V.-A. 20—21; A.-C. 10—11; in lateral series O.-V. 22—23; V.-A. 20—21.

Atlantic.

A specimen 65 mm. in length to base of caudal, from station 1387, with 4000 metres of wire out. Two in the British Museum (Natural History), 43 and 45 mm. long, from off Ireland.

4. HETEROPHOTUS gen. nov.

Cleft of mouth somewhat curved, very wide. Teeth small, without well-marked canines; maxillary teeth erect, numerous (from 15 in the young to more than 40 in the adult). A series of teeth on each palatine and a pair on the vomer. Gill-arches bearing small teeth, usually in pairs. No teeth on the hyoid arch. Pelvic fins posterior, nearer to caudal fin than to head. Photophores in ventral series mostly grouped into little series of subcontiguous photophores. Post-temporal absent; supracleithrum remote from and unconnected with skull. Stomach large.

HETEROPHOTUS OPHISTOMA sp. n.

(Pl. VI, fig. 1).

Depth of body $4^3/_4$ to $6^4/_5$ in length, length of head $3^3/_5$ to $4^4/_5$. Diameter of eye 5 to 8 in length of head. Post-ocular luminous organ close to eye, generally longer than it. Barbel from $^1/_2$ to as long as head, slender, black, with a white, tapering tip, which is not or but little swollen. Dorsal 11—13, originating above or just behind pelvics, ending far in front of anal. Anal 14—17. Pectoral 7. Pelvics 7-rayed, their distance from caudal $^1/_2$ to $^2/_3$ that from end of snout. A dorsal adipose fin above middle of anal, but no ventral adipose fin in adult. Photophores in ventral series I.-P. 10—11 (1+2+3+4 or 1+3+3+4); P.-V. 32—35 (in linear groups of 1 to 5); V.-A. 14—16 (generally a linear group of 5—7 posteriorly); A.-C. 13—14, not in groups, with the middle ones higher than the rest as in *B. braueri*; in lateral series O.-V. 33—36; V.-A. 16 or 17; not in groups except the first 4 or 5 behind the operculum.

Atlantic.

Nine specimens, 45 to 300 mm. in length to base of caudal, taken at stations 1163, 1166, 1168, 1172, 1202, 1217, 1284, 1285, with 600 to 2500 metres of wire out.

5. RHADINESTHES, gen nov.

Form much more elongate than in other Astronesthidae. Cleft of mouth straight. Teeth in jaws unequal, with small curved fangs mixed with much smaller teeth; praemaxillaires probably extending nearly to angle of mouth; maxillary short, with minute, almost vestigial teeth. A pair of teeth on vomer and a series on each palatine. Teeth on gill-arches small, in pairs; none on ceratohyal. Post-ocular luminous organ single. Post-temporal present. Stomach large.

1. RHADINESTHES DECIMUS, Zugmayer, 1911.

Astronesthes decimus, Zugmayer, Res. Camp. Sci. Monaco, XXXV, 1911, p. 80, pl. III, fig. 6.

Depth of body 11 in the length, length of head $6^1/_2$. Diameter of eye $6^1/_4$ in length of head. Post-ocular luminous organ small, well separated from eye. Total length of maxillary about equal to diameter of eye, the broader posterior part with toothed edge about half as long. Lower jaw $^9/_{10}$ length

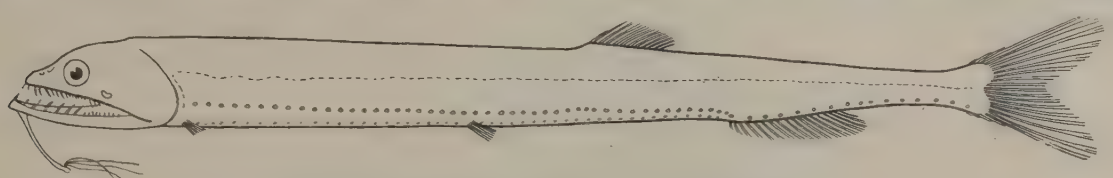


Fig. 20. *Rhadinesthes decimus* (× $^1/_3$). After Zugmayer.

of head. Longest fang about $^1/_3$ diameter of eye. Barbel $^1/_2$ length of head to end of bulb; stem black, with luminous patches most developed near the swollen end, which is separated from the bulb by a constriction; bulb rounded, white, with four filaments arising together from its base. Dorsal 12, inserted far behind pelvics and ending far in front of anal. Anal 19, ending at a distance from caudal equal to length of its own base. Pectoral 7—8. Pelvic 7; origin nearly equidistant from end of snout and end of anal fin. Photophores (*fide* Zugmayer) I.-P. 6; P.-V. 26; V.-A. 23; A.-C. 15. An undulating white line along middle of side.

Atlantic.

The type, 315 mm. in length to base of caudal, has been kindly sent to us for examination by Dr. Richard and Professor Roule. The praemaxillaires are missing, except for a detached fragment, and this may be the reason why the lower jaw appears so prominent in Zugmayer's figure.

6. NEONESTHES, gen nov.

Form moderately elongate. Praemaxillaires curved upwards in front and meeting at an angle. Teeth in both jaws feeble; maxillary teeth erect and similar to the others. A series of weak palatine teeth and a pair on the vomer. Gill-arches bearing numerous pairs of slender teeth, close-set, much longer than the teeth on the jaws; a series of similar teeth on cerato-hyal. Post-ocular luminous organ very large. Anal fin long, of 25 to 28 rays, ending near caudal. Post-temporal rather slender. Stomach comparatively small.

The fishes of the preceding genera appear to be largely piscivorous, or at least to feed on prawns etc. of fair size; they have the teeth on the gill-arches relatively short and stout, with the teeth, or pairs of teeth, well separated; they have also a very large stomach that extends far back. *Neonesthes* evidently feeds on smaller prey, and in relation to this the teeth in the jaws are feeble, the teeth on the gill-arches resemble setiform gill-rakers, and the stomach is comparatively small, in the anterior part of the abdominal cavity.

1. NEONESTHES MACROLYCHNUS, sp. n.

(Pl. VI, fig. 2).

Depth of body 5 to $6^{3}/_{4}$ in length, length of head $4^{1}/_{2}$ to $5^{1}/_{2}$. Snout short; diameter of eye 4 to 5 in length of head. Post-ocular luminous body 3 to 5 in length of head, with a narrow anterior sub-ocular prolongation mostly covered by a pigment layer but exposed in front. Barbel $^{3}/_{5}$ to $1^{3}/_{8}$ length of head, ending in a swollen bulb; stem not heavily pigmented except for a small area carrying two white luminous organs immediately below the bulb. Dorsal 10—12, short, above interspace between pelvics and anal. Anal 25—28. Pectoral 8. Pelvics 7-rayed, considerably nearer to snout than to caudal. A long, low ventral adipose fin. Photophores in ventral series I.-P. 10—12; P.-V. 15—16: V.-A. 16—19; A.-C. 13—18; in lateral series O.-V. 13—15; V.-A. 15—20.

Fig. 21. *Neonesthes macrolychnus*. End of barbel, posterior view.

N. Atlantic.

Six specimens, 35 to 150 mm. in length to base of caudal, from stations 1160, 1243, 1353, 1358 and 1365, with 200 to 1000 metres of wire out.

The barbel seems to increase in relative length with growth, but there is some variation. In specimens of 35 and 42 mm. it is $^{3}/_{5}$ the length of the head, in one of 38 mm. $^{2}/_{3}$ the length of head; in specimens of 50 and 140 mm. it is as long as the head, and in the 144 mm. fish, although incomplete, $1^{3}/_{8}$ the length of the head.

The position of the dorsal fin varies considerably; in some specimens it is nearer to pelvics than anal, in others nearer the anal.

N. macrolychnus may prove to be a synonym of *Astronesthes capensis*, Gilchrist and von Bonde, 1924 (Rep. Fish. Mar. Biol. Surv., III No. 7, p. 5) based on a damaged speeimen of 170 mm. from S. Africa. They give photophores I.-P. 14; P.-V. 13; in other respects the details apply to *N. macrolychnus*, but as the post-ocular luminous organ and the structure of the barbel are not described we do not feel justified in referring the "Dana" specimens to this species.

7. THE CHAULIODONTIDAE

This family includes the single genus *Chauliodus*, distinguished externally from the Astronesthidae by the long compressed body covered with large thin scales, and by the anterior position of the dorsal fin, the first ray of which is produced into a filament. Other notable characters are the very small barbel, mental in position, and the very strøng curved fangs with straight slightly barbed ends, of which

a pair at the anterior end of the lower jaw are longest. The maxillary has a close-set series of small teeth directed obliquely backwards, and there is a series of teeth on each palatine; the teeth on the gill-arches are minute. Dorsal and ventral adipose fins are present.

A pair of tendons running forward from anterior dorsal muscles are inserted on the top of the skull, as in *Stylophorus*, and as in that genus pull the head upwards and backwards when the muscles are contracted. In this position, with the mouth open wide, the anterior fangs of the lower jaw would strike upwards (fig. 24, p. 32).

The skull of *Chauliodus* resembles that of *Astronesthes* in structure, except that the frontals do not extend so far back, and the well-developed epiotics appear at the sides of the supraoccipital; from them ridges extend forward on the frontals; minute flakes of bone adherent to the epiotics may represent the parietals.

The most remarkable feature of the skeleton of *Chauliodus* is the enormous first vertebra, as long as the next five, with a very large single parapophysis below, and above with long paired laminae representing the neural arch. This enlargement of the first vertebra may be related to the habit of throwing back the head, taking the strain in the same way as the interlocked anterior vertebrae of *Stylophorus*. The rest of the vertebral column, the pectoral arch (without a post-temporal), suspensorium, etc. of *Chauliodus* are extremely like those of the Astronesthidae. The visceral anatomy is also similar, but the stomach differs in being unpigmented.

The "Dana" specimens of *Chauliodus* belong to three species, namely *C. sloanei*, Schn. and *C. danae* sp. n. from the Atlantic, and *C. barbatus*, Garm. from the Gulf of Panama.

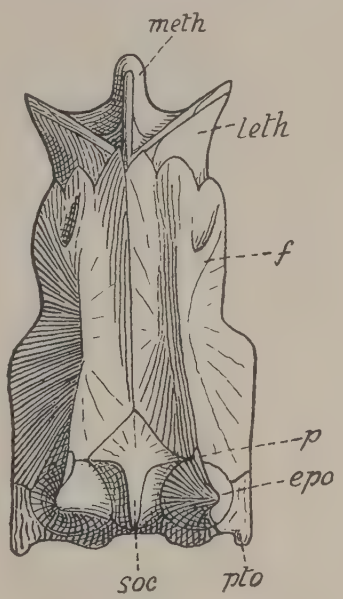


Fig. 22. *Chauliodus sloanei.* Skull seen from above. *epo*, epiotic; *f*, frontal; *leth*, lateral ethmoid; *meth*, mesethmoid; *p*, parietal; *pto*, pterotic; *soc*, supraoccipital.

Of other species that have been described perhaps the most distinct is *Chauliodus dentatus*, Garman (Mem. Mus., Comp. Zool. XXIV, 1899, p. 273) from the Society Islands, of which *Chauliodus emmelas*, Jordan & Starks, 1904 (Bull. U. S. Fish. Comm. XXII, 1902, p. 579, pl. I, fig. 2) from Japan, may be a

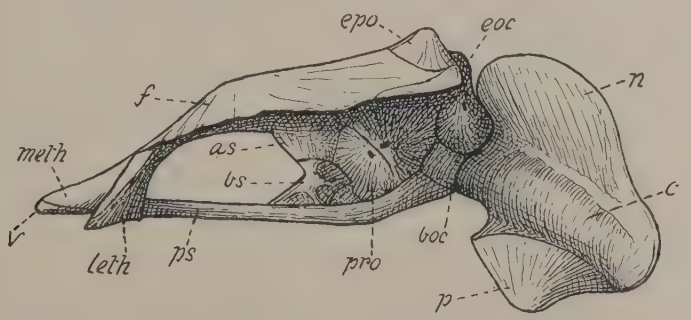


Fig. 23. *Chauliodus sloanei.* Lateral view of skull and first vertebra. Skull. *as*, alisphenoid; *bs*, basisphenoid; *boc*, basioccipital; *eoc*, exoccipital; *epo*, epiotic; *f*, frontal; *leth*, lateral ethmoid; *meth*, mesethmoid; *ps*, parasphenoid; *pro*, prootic; *v*, vomer. First vertebra. *c*, centrum; *n*, neural arch; *p*, parapophysis.

synonym. This is probably the species recorded from off California by Gilbert as *C. macouni* (Proc. U. S. Nat. Mus. XLVIII, 1915, p. 321). The large number of photophores, V.-A. 26—29, distinguishes this species.

Chauliodus pammelas, Alcock (Cat. Indian Deep Sea Fish, p. 145 and Ill. Zool. "Investigator" pl. XXX, fig. 4 (1899); Brauer, "Valdivia" Tiefseefische p. 42 (1906)) from the Indian Ocean, has the same number of photophores as *C. barbatus*, but is probably distinct.

1. CHAULIODUS SLOANEI, Schneider, 1801.

Bloch's Syst. Ichth. p. 430; Günth. Cat. Fish. V, p. 392 (1864).

Chauliodus setinotus, Schneid. o. c. pl. LXXXV.

Esox stomias, Shaw, Gen. Zool. V, p. 120 (1804).

Chauliodus schneideri, Risso, Eur. Mérid. III, p. 442 (1826).

? *Chauliodus dannevigi*, Mc Culloch, Biol. Res. "Endeavour", IV (4) 1916, p. 179, pl. III.

Depth of head 7 to 8 in length to base of caudal, equal to or slightly greater than length of lower jaw. Diameter of eye $2^2/_3$ to $4^1/_2$ in length of lower jaw, larger in male than in female. Oblique denticles at posterior end of lower jaw rarely distinguishable. 15 to 19 branchiostegal rays, usually 17 or 18. Barbel minute and conical or reduced to a stump in adult, relatively longer in young, but in these slender and tapering, never flattened and rigid as in *C. barbatus* and the young of *C. danae*. Photophores of the ventral series I.-P. 10, rarely 9, P.-V. 18—21, usually 19 or 20; V.-A. 22—27, usually 25 or 26; of

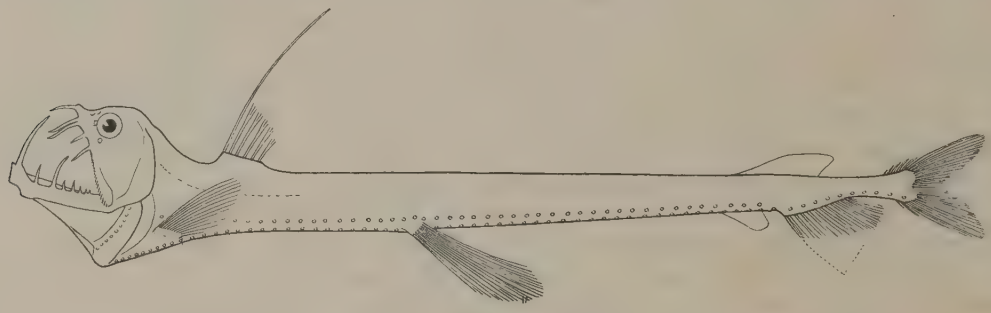


Fig. 24. *Chauliodus sloanei.*

the lateral series, O.-V. 18—21, usually 19 or 20; V.-A. 22—27, usually 25 or 26; of the single caudal series 10—13, usually 11 or 12. Total number of photophores in lateral and caudal series 52—59, average 56·39 (Fig. 25, A). Unpigmented photophores minute, invisible to the naked eye, not forming distinct, paired groups on the ventral surface; those of dorsal and ventral surfaces generally torn off with the outer layers of the skin. In four specimens, respectively with 54, 55, 57 and 57 photophores in a longitudinal series, the corresponding numbers of vertebrae are 56, 58, 59 and 59. Dorsal 6; first ray above 6th to 8th photophore of the lateral series, usually 6th. Anal 11—13, usually 11 or 12. Pectoral 11—14. Pelvic 7. In each of four specimens examined there are 3 pyloric caeca, but the number recorded varies from 2 to 4.

Mediterranean; Atlantic; Caribbean Sea; Japan; ? Australia.

The collection includes 291 specimens, 20 to 270 mm. in total length. The photophores were counted in 175 specimens.

A fish from south of Japan ("Challenger" Station 235) in the British Museum (Natural History) agrees in every way with *C. sloanei*. It is 160 mm. in total length. The photophores of the lateral and caudal series number O.-V. 20; V.-A. 25; A.-C. 12. If *C. dannevigi* be the same this species occurs also in Australia.

C. sloanei was collected at the following stations:

St. 63, 1200 MW. (1, 155 mm.).
St. 152, 1000 M.W. (1, 32 mm.).
St. 156, 1000 M.W. (1, 30 mm.).
St. 160, 4000 M.W. (1, 25 mm.).
St. 175, 1050 M.W. (1, 45 mm.).
St. 231, 1200 M.W. (9, 25—35 mm.).
St. 232, 1000 M.W. (1, 32 mm.).
St. 826, 300 M.W. (2, 70—75 mm.).

St. 830, 300 M.W. (1, 22 mm.).
St. 849, 500 M.W. (1, 26 mm.).
St. 850, 300 M.W. (1, 25 mm.).
St. 880, 100 M.W. (1, 57 mm.).
St. 903, 50 M.W. (1, 25 mm.).
St. 948, 200 M.W. (1, 70 mm.).
St. 949, 200 M.W. (1, 22 mm.).
St. 1015, 3000 M.W. (1, 30 mm.).
4000 M.W. (1, 70 mm.).
St. 1030, 1000 M.W. (1, 30 mm.).
St. 1072, 150 M.W. (1, 25 mm.).
St. 1107, 100 M.W. (1, 90 mm.).
200 M.W. (1, 90 mm.).
St. 1108, 300 M.W. (3, 25—85 mm.).
St. 1110, 300 M.W. (2, 75, 80 mm.).
St. 1111, 300 M.W. (3, 100 mm.).
St. 1113, 300 M.W. (2, 90, 95 mm.).
St. 1116, 250 M.W. (1, 95 mm.).
300 M.W. (6, 40—95 mm.).
400 M.W. (5, 92—115 mm.).
St. 1119, 300 M.W. (1, 45 mm.).
St. 1122, 150 M.W. (1, 30 mm.).
200 M.W. (1, 40 mm.).
300 M.W. (1, 50 mm.).
St. 1123, 200 M.W. (4, 30—55 mm.).
St. 1139, 200 M.W. (1, 65 mm.).
300 M.W. (1, 90 mm.).
St. 1141, 300 M.W. (1, 90 mm.).
350 M.W. (1, 110 mm.).
500 M.W. (2, 90 mm.).
600 M.W. (4, 85—105 mm.).
St. 1142, 600 M.W. (1, 85 mm.).
St. 1157, 1000 M.W. (1, 140 mm.).
St. 1159, 1000 M.W. (1, 70 mm.).
2000 M.W. (2, 25, 70 mm.).
St. 1160, 300 M.W. (2, 35, 115 mm.).
St. 1161, 100 M.W. (3, 25—35 mm.).
St. 1162, 300 M.W. (1, 70 mm.).
600 M.W. (1, 125 mm.).
St. 1163, 100 M.W. (1, 30 mm.).
300 M.W. (1, 85 mm.).
1000 M.W. (1, 170 mm.).
St. 1165, 1000 M.W. (1, 80 mm.).
2000 M.W. (2, 25 mm.).
3000 M.W. (1, 30 mm.).
5000 M.W. (1, 235 mm.).
St. 1166, 1000 M.W. (3, 75—200 mm.).
St. 1168, 1000 M.W. (1, 215 mm.).
St. 1171, 300 M.W. (1, 95 mm.).
St. 1172, 300 M.W. (5, 40—90 mm.).
St. 1174, 300 M.W. (4, 55—105 mm.).
St. 1178, 200 M.W. (1, 30 mm.).
600 M.W. (1, 35 mm.).
St. 1183, 300 M.W. (1, 80 mm.).
1000 M.W. (1, 110 mm.).
2500 M.W. (11, 25—75 mm.).
3000 M.W. (2, 60, 120 mm.).
3500 M.W. (4, 30—205 mm.).
4500 M.W. (2, 90, 160 mm.).
St. 1184, 300 M.W. (2, 55, 110 mm.).
1000 M.W. (1, 125 mm.).
St. 1185, 300 M.W. (1, 70 mm.).
2000 M.W. (1, 60 mm.).
6000 M.W. (1, 120 mm.).
St. 1186, 100 M.W. (1, 30 mm.).
St. 1189, 300 M.W. (1, 80 mm.).
St. 1192, 600 M.W. (2, 95, 125 mm.).
St. 1195, 600 M.W. (1, 45 mm.).
St. 1196, 1000 M.W. (1, 120 mm.).
St. 1198, 200 M.W. (1, 25 mm.).
800 M.W. (1, 120 mm.).
St. 1202, 300 M.W. (2, 25, 40 mm.).
St. 1216, 600 M.W. (1, 120 mm.).
St. 1223, 300 M.W. (2, 70, 80 mm.).
600 M.W. (1, 140 mm.).
St. 1225, 600 M.W. (1, 210 mm.).
St. 1228, 300 M.W. (2, 55, 80 mm.).
St. 1229, 600 M.W. (1, 95 mm.).
St. 1231, 300 M.W. (2, 25, 70 mm.).
600 M.W. (1, 210 mm.).
1000 M.W. (1, 125 mm.).
St. 1236, 300 M.W. (1, 25 mm.).
St. 1240, 1000 M.W. (1, 80 mm.).
St. 1242, 1500 M.W. (1, 70 mm.).
St. 1243, 300 M.W. (1, 80 mm.).
St. 1245, 1050 M.W. (1, 30 mm.).
St. 1247, 1000 M.W. (1, 105 mm.).
St. 1250, 600 M.W. (1, 35 mm.).
St. 1260, 300 M.W. (4, 35—85 mm.).
St. 1266, 600 M.W. (2, 30 mm.).
St. 1269, 600 M.W. (1, 80 mm.).
1500 M.W. (1, 45 mm.).
St. 1270, 1000 M.W. (1, 75 mm.).
St. 1272, 300 M.W. (1, 25 mm.).

St. 1272, 1000 M.W. (2, 110, 180 mm.).
St. 1273, 300 M.W. (4, 30—90 mm.).
500 M.W. (2, 65—95 mm.).
800 M.W. (1, 70 mm.).
1000 M.W. (1, 200 mm.).
1200 M.W. (1, 190 mm.).
St. 1274, 100 M.W. (1, 80 mm.).
St. 1276, 300 M.W. (1, 70 mm.).
St. 1278, 800 M.W. (1, 160 mm.).
St. 1279, 100 M.W. (2, 65, 75 mm.).
300 M.W. (2, 100—120 mm.).
1000 M.W. (1, 170 mm.).
St. 1280, 100 M.W. (2, 20, 45 mm.).
300 M.W. (1, 110 mm.).
St. 1281, 300 M.W. (4, 30—115 mm.).
700 M.W. (1, 180 mm.).
St. 1283, 300 M.W. (1, 210 mm.).
St. 1285, 600 M.W. (1, 90 mm.).
1000 M.W. (1, 200 mm.).
St. 1286, 300 M.W. (1, 35 mm.).
St. 1287, 1000 M.W. (1, 270 mm.).
St. 1289, 300 M.W. (2, 50, 120 mm.).
600 M.W. (1, 50 mm.).
800 M.W. (1, 45 mm.).
St. 1291, 300 M.W. (2, 90, 100 mm.).
600 M.W. (1, 125 mm.).
St. 1292, 100 M.W. (3, 45 mm.).
300 M.W. (3, 30—100 mm.).
St. 1293, 100 M.W. (2, 40, 60 mm.).
300 M.W. (1, 40 mm.).
St. 1294, 100 M.W. (1, 25 mm.).
300 M.W. (3, 40—100 mm.).
St. 1296, 100 M.W. (3, 40—85 mm.).
300 M.W. (2, 90, 115 mm.).
St. 1314, 100 M.W. (3, 35—40 mm.).
St. 1321, 100 M.W. (1, 25 mm.).
St. 1339, 300 M.W. (2, 65, 70 mm.).
St. 1341, 150 M.W. (2, 60, 70 mm.).
300 M.W. (1, 85 mm.).
St. 1342, 2000 M.W. (1, 60 mm.).
St. 1349, 1000 M.W. (3, 135—185 mm.).
St. 1352, 300 M.W. (1, 25 mm.).
St. 1353, 150 M.W. (3, 60—75 mm.).
200 M.W. (3, 50—75 mm.).
300 M.W. (1, 60 mm.).
St. 1363, 300 M.W. (1. 70 mm.).
St. 1365, 4000 M.W. (1, 25 mm.).
St. 1370, 300 M.W. (1, 80 mm.).
2000 M.W. (1, 30 mm.).
St. 1371, 300 M.W. (4, 85—105 mm.).
600 M.W. (1, 135 mm.).
St. 1372, 300 M.W. (2, 85, 105 mm.).
1000 M.W. (1, 165 mm.).
3000 M.W. (1, 105 mm.).
St. 1374, 200 M.W. (2, 75, 100 mm.).
300 M.W. (1, 90 mm.).
1000 M.W. (1, 150 mm.).
St. 1377, 200 M.W. (1, 95 mm.).
300 M.W. (5, 80—130 mm.).
1000 M.W. (1, 70 mm.).
St. 1378, 300 M.W. (3, 70—80 mm.).
400 M.W. (2, 70 mm.).
St. 1380, 200 M.W. (1, 65 mm.).
300 M.W. (1, 95 mm.).
600 M.W. (2, 150, 160 mm.).
1000 M.W. (5, 20—85 mm.).
St. 1385, 800 M.W. (1, 90 mm.).

Chauliodus sloanei is evidently a larger species than *C. danae*, and seems generally to inhabit greater depths. HJORT's conclusion that it is most abundant about 500 metres below the surface is not negatived by the "Dana" results, for a good many adults were taken with nets fishing at about this depth (1000 metres of wire out), including the largest, 270 mm. at St. 1287. However, some over 200 mm. long were taken at lesser depths, e. g. at St. 1283, with 300 metres of wire out, and at Sts. 1225 and 1231 with 600 metres of wire out. Fish up to 80 mm. long were taken with 100 metres of wire out.

2. CHAULIODUS DANAE, sp. n. (Pl. VII).

Depth of head 7 to 8 in length to base of caudal, equal to or slightly greater than length of lower jaw. Diameter of eye $2^1/_2$ to 4 in length of lower jaw, larger in male than in female. A series of 3 to 8 minute, oblique denticles usually clearly distinguishable by means of a lens at posterior end of

lower jaw. 14 to 18 branchiostegal rays, usually 15. Barbel minute, slender, tapering or reduced to a stump in adult, but relatively longer in young fishes up to 55 mm. in length, in which it is laterally compressed and stiffened by an axial rod as in *C. barbatus*. Photophores of the ventral series, I.-P. 10, rarely 9; P.-V. 17—20, usually 19; V.-A. 22—25, usually 23 or 24; of the lateral series, O.-V. 17—20, usually 19, V.-A. 22—25, usually 23 or 24; of the single caudal series 9—12, usually 10 or 11. Total number of photophores in lateral and caudal series 51—56, average 52.85 (Fig. 25, B). Unpigmented pho-

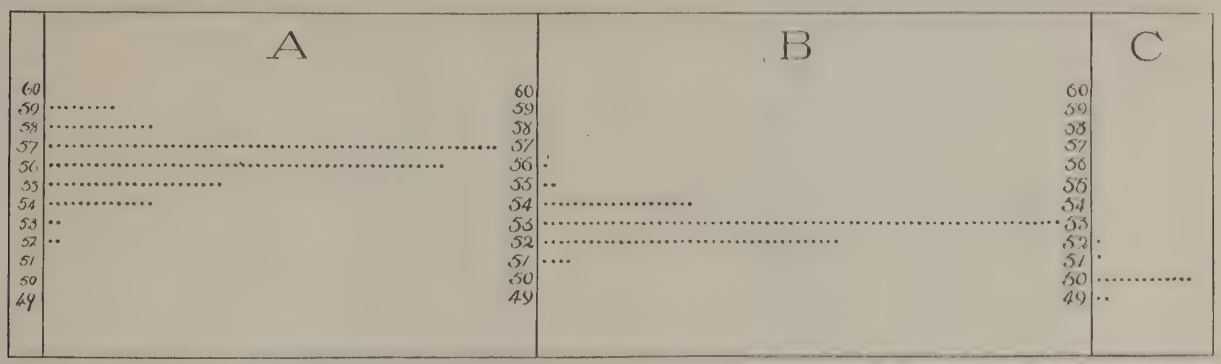


Fig. 25. Number of photophores (lateral + caudal series) in *A. Chauliodus sloanei* (175 specimens), B. *Chauliodus danae* (134 specimens) and C. *Chauliodus barbatus* (17 specimens).

tophores minute, invisible to the naked eye, as in *C. sloanei*. In four specimens with 51, 52, 52 and 53 photophores respectively in a longitudinal series, the corresponding numbers of vertebrae are 53, 55, 55, 56. Dorsal 6, about equidistant from pectorals and ventrals; first ray above 9th or 10th lateral photophore, rarely above 8th or 11th. Anal 11 or 12. Pectoral 12—14. Pelvic 7. In each of four specimens examined there are 3 pyloric caeca.

Atlantic; Caribbean Sea; Indian Ocean; New Guinea.

The collection includes 1,015 specimens. A large number of these are young fish 20—50 mm. in length. Adults measure up to 140 mm. The lateral and caudal photophores were counted in 134 specimens.

This species is close to *C. sloanei*, from which it differs in the position of the dorsal fin, the lower average number of photophores and vertebrae, and the structure of the barbel in the young.

Three specimens in the collection of the British Museum (Natural History) seem to belong to *C. danae*, and extend its range to the Indian Ocean and New Guinea.

They are (1). Indian Ocean, Gardiner Coll. Length 120 mm. Photophores O.-V. 19; V.-A. 23; A.-C. 11.

(2). S. of New Guinea, "Challenger" St. 191. Length 210 mm. Photophores O.-V. 20; V.-A. 25; A.-C. 11. Much larger than any specimen taken in the Atlantic.

(3). N. of New Guinea, "Challenger" St. 216. Length 70 mm. Photophores O.-V. 20; V.-A. 23; A.-C. 12.

Specimens of *Chauliodus danae* were collected in the N. Atlantic and Caribbean Sea as follows.

St. 812,	(1, 20 mm.).	St. 835,	100 M.W. (1, 30 mm.).
St. 822,	100 M.W. (3, 23—28 mm.).	St. 836,	300 M.W. (10, 22—100 mm.).
St. 828,	300 M.W. (1, 35 mm.).	St. 839,	300 M.W. (3, 45—102 mm.).
St. 830,	100 M.W. (1, 28 mm.).	St. 842,	300 M.W. (2, 60, 75 mm.).
St. 831,	50 M.W. (2, 25—28 mm.).	St. 844,	300 M.W. (1, 20 mm.).
	100 M.W. (8, 20—30 mm.).	St. 850,	300 M.W. (1, 25 mm.).
	300 M.W. (8, 20—37 mm.).	St. 851,	100 M.W. (1, 25 mm.).
St. 832,	300 M.W. (7, 20—30 mm.).	St. 852,	200 M.W. (1, 22 mm.).
St. 834,	300 M.W. (7, 20—50 mm.).	St. 855,	100 M.W. (3, 20—27 mm.).

St. 855, 200 M.W. (6, 20—75 mm.).
300 M.W. (17, 15—25 mm.).
500 M.W. (1, 85 mm.).
St. 856, 50 M.W. (1, 25 mm.).
St. 857, 150 M.W. (1, 50 mm.).
St. 858, 200 M.W. (1, 100 mm.).
St. 859, 150 M.W. (1, 20 mm.).
200 M.W. (2, 25, 65 mm.).
St. 864, 100 M.W. (1, 28 mm.).
150 M.W. (1, 22 mm.).
St. 866, 200 M.W. (2, 20, 22 mm.).
St. 873, 100 M.W. (1, 24 mm.).
St. 874, 100 M.W. (1, 25 mm.).
150 M.W. (2, 21, 23 mm.).
St. 877, 150 M.W. (1, 40 mm.).
St. 883, 100 M.W. (1, 30 mm.).
St. 886, 150 M.W. (1, 30 mm.).
St. 887, 150 M.W. (1, 20 mm.).
St. 888, 100 M.W. (1, 18 mm.).
St. 891, 150 M.W. (1, 35 mm.).
200 M.W. (2, 22, 32 mm.).
St. 908, 200 M.W. (1, 88 mm.).
St. 914, 150 M.W. (2, 108 mm.).
St. 917, 1200 M.W. (1, 30 mm.).
St. 922, 300 M.W. (2, 22—23 mm.).
St, 923, 200 M.W. (2, 20, 25 mm.).
St. 924, 300 M.W. (1, 107 mm.).
St. 926, 300 M.W. (2, 30, 88 mm.).
St. 928, 300 M.W. (2, 20 mm.).
St. 929, 150 M.W. (1, 30 mm.).
St. 931, 150 M.W. (2, 30, 43 mm.).
200 M.W. (1, 50 mm.).
St. 932, 300 M.W. (2, 80 mm.).
St. 934, 300 M.W. (2, 30, 40 mm.).
St. 935, 150 M.W. (2, 22 mm.).
200 M.W. (1, 25 mm.).
300 M.W. (5, 20—30 mm.).
St. 937, 400 M.W. (3, 40—58 mm.).
500 M.W. (1, 23 mm.).
St. 938, 600 M.W. (1, 24 mm.).
St. 939, 200 M.W. (1, 24 mm.).
400 M.W. (10, 20—30 mm.).
500 M.W. (6, 20—114 mm.).
St. 941, 200 M.W. (2, 20 mm.).
300 M.W. (1, 22 mm.).
400 M.W. (8, 23—27 mm.).
1000 M.W. (4, 80—130 mm.).
St. 942, 200 M.W. (1, 21 mm.).
St. 943, 200 M.W. (3, 20 mm.).
300 M.W. (1, 24 mm.).
400 M.W. (6, 20—30 mm.).
St. 944, 100 M.W. (2, 20 mm.).
300 M.W. (1, 30 mm.).
400 M.W. (5, 22 mm.).
St. 945, 200 M.W. (2, 20, 93 mm.).
300 M.W. (4, 20—30 mm.).
St. 946, 100 M.W. (1, 23 mm.).
400 M.W. (1, 25 mm.).
St. 947, 300 M.W. (1, 20 mm.).
900 M.W. (2, 46, 75 mm.).
St. 950, 300 M.W. (1, 120 mm.).
400 M.W. (1, 100 mm.).
St. 1014, 150 M.W. (12, 25—50 mm.).
300 M.W. (1, 32 mm.).
St. 1016, 150 M.W. (3, 22—30 mm.).
300 M.W. (6, 20—30 mm.).
St. 1017, 150 M.W. (4, 25—115 mm.).
300 M.W. (1, 80 mm.).
St. 1018, 65 M.W. (1, 25 mm.).
150 M.W. (11, 20—55 mm.).
300 M.W. (3, 20—80 mm.).
St. 1019, 65 M.W. (4, 20—30 mm.).
150 M.W. (20, 20—50 mm.).
300 M.W. (1, 56 mm.).
St. 1022, 3000 M.W. (1, 105 mm.).
St. 1030, 300 M.W. (1, 62 mm.).
St. 1031, 65 M.W. (1, 20 mm.).
150 M.W. (14, 20—30 mm.).
St. 1032, 65 M.W. (2, 25—30 mm.).
150 M.W. (2, 32 mm.).
300 M.W. (1, 30 mm.).
600 M.W. (1, 35 mm.).
St. 1033, 80 M.W. (20, 20—30 mm.).
St. 1035, 65 M.W. (17, 20—60 mm.).
150 M.W. (21, 20—35 mm.).
300 M.W. (1, 30 mm.).
1000 M.W. (2, 88, 92 mm.).
St. 1039, 80 M.W. (1, 20 mm.).
St. 1040, 110 M.W. (13, 20—30 mm.).
St. 1041, 80 M.W. (2, 22, 25 mm.).
St. 1042, 65 M.W. (5, 20—25 mm.).
80 M.W. (28, 20—30 mm.).
St. 1043, 150 M.W. (46. 25—50 mm.).
St. 1056, 65 M.W. (1, 25 mm.).

St. 1056, 80 M.W. (1, 25 mm.).
St. 1059, 65 M.W. (1, 25 mm.).
St. 1061, 150 M.W. (1, 20 mm.).
St. 1062, 600 M.W. (1, 102 mm.).
St. 1067, 110 M.W. (1, 38 mm.).
150 M.W. (4, 25—35 mm.).
St. 1070, 150 M.W. (2, 20, 22 mm.).
St. 1071, 150 M.W. (3, 20—24 mm.).
St. 1072, 150 M.W. (3, 20—30 mm.).
St. 1140, 400 M.W. (2, 25, 45 mm.).
St. 1142, 600 M.W. (10, 25—40 mm.).
St. 1145, 300 M.W. (1, 30 mm.).
400 M.W. (2, 25, 30 mm.).
500 M.W. (5, 20—30 mm.).
St. 1146, 500 M.W. (3, 25—35 mm.).
St. 1149, 250 M.W. (1, 25 mm.).
350 M.W. (1, 30 mm.).
St. 1150, 300 M.W. (1, 30 mm.).
St. 1152, 600 M.W. (4, 25—35 mm.).
7000 M.W. (1, 90 mm.).
St. 1153, 300 M.W. (16, 20—45 mm.).
400 M.W. (36, 25—55 mm.).
500 M.W. (6, 50—110 mm.).
St. 1155, 200 M.W. (4, 20—25 mm.).
400 M.W. (1, 50 mm.).
St. 1156, 600 M.W. (3, 30—45 mm.).
800 M.W. (2, 60, 70 mm.).
1000 M.W. (1, 80 mm.).
St. 1157, 100 M.W. (1, 85 mm.).
300 M.W. (3, 30—50 mm.).
600 M.W. (2, 64, 67 mm.).
800 M.W. (3, 76—112 mm.).
1000 M.W. (1, 65 mm.).
3000 M.W. (1, 50 mm.).
St. 1159, 300 M.W. (1, 120 mm.).
600 M.W. (3, 80—100 mm.).
1000 M.W. (1, 110 mm.).
2000 M.W. (2, 25, 50 mm.).
St. 1182, 600 M.W. (1, 135 mm.).
St. 1184, 1000 M.W. (2, 105, 120 mm.).
St. 1185, 300 M.W. (5, 25—35 mm.).
800 M.W. (2, 50, 75 mm.).
1000 M.W. (2, 30, 45 mm.).
1500 M.W. (1, 120 mm.).
2000 M.W. (1, 50 mm.).
St. 1186, 100 M.W. (1, 27 mm.).
St. 1189, 600 M.W. (1, 95 mm.).
St. 1198, 1200 M.W. (1, 90 mm.).
St. 1223, 300 M.W. (7, 25—30 mm.).
St. 1236, 300 M.W. (1, 40 mm.).
St. 1238, 600 M.W. (1, 65 mm.).
St. 1239, 500 M.W. (2, 40, 50 mm.).
1000 M.W. (1, 80 mm.).
1500 M.W. (4, 40—60 mm.).
4500 M.W. (2, 65, 72 mm.).
St. 1241, 400 M.W. (1, 38 mm.).
500 M.W. (4, 40—50 mm.).
600 M.W. (1, 60 mm.).
1500 M.W. (1, 62 mm.).
St. 1242, 300 M.W. (5, 30—110 mm.).
400 M.W. (4, 16—25 mm.).
1000 M.W. (1, 65 mm.).
1500 M.W. (1, 70 mm.).
2000 M.W. (1, 20 mm.).
3500 M.W. (1, 65 mm.).
St. 1243, 300 M.W. (1, 45 mm.).
St. 1253, 1000 M.W. (2, 30, 120 mm.).
St. 1260, 300 M.W. (2, 20 mm.).
St. 1261, 2500 M.W. (1, 35 mm.).
St. 1266, 800 M.W. (1, 130 mm.).
St. 1267. 4500 M.W. (1, 120 mm.).
St. 1268, 1000 M.W. (1, 76 mm.).
St. 1270, 600 M.W. (2, 50, 60 mm.).
St. 1282, 600 M.W. (1, 115 mm.).
St. 1286, 1000 M.W. (1, 80 mm.).
St. 1321, 500 M.W. (1, 30 mm.).
St. 1322, 200 M.W. (1, 30 mm.).
400 M.W. (18, 15—115 mm.).
600 M.W. (7, 25—95 mm.).
700 M.W. (4, 35—50 mm.).
800 M.W. (2, 20, 25 mm.).
1300 M.W. (1, 20 mm.).
1400 M.W. (2, 25, 110 mm.).
1600 M.W. (1, 20 mm.).
5200 M.W. (1, 55 mm.).
St. 1323, 700 M.W. (4, 20—115 mm.).
St. 1326, 200 M.W. (1, 35 mm.).
300 M.W. (4, 30—35 mm.).
600 M.W. (1, 30 mm.).
1100 M.W. (2, 95, 110 mm.).
St. 1327, 300 M.W. (2, 85 mm.).
600 M.W. (4, 20—75 mm.).
St. 1328, 900 M.W. (2, 30, 120 mm.).
St. 1330, 200 M.W. (4, 25—30 mm.).

St. 1330, 400 M.W. (6, 30—110 mm.).
500 M.W. (2, 55, 70 mm.).
St. 1331, 1500 M.W. (4, 25—35 mm.).
1700 M.W. (3, 30—95 mm.).
St. 1332, 300 M.W. (17, 20—55 mm.).
400 M.W. (4, 25—110 mm.).
500 M.W. (3, 25—45 mm.).
1000 M.W. (1, 80 mm.).
St. 1333, 500 M.W. (1, 30 mm.).
St. 1334, 100 M.W. (1, 35 mm.).
300 M.W. (1, 25 mm.).
600 M.W. (2, 65, 100 mm.).
St. 1335, 300 M.W. (8, 20—30 mm.).
1000 M.W. (1, 65 mm.).
St. 1336, 300 M.W. (1, 25 mm.).
St. 1337, 600 M.W. (3, 70—85 mm.).
1000 M.W. (1, 60 mm.).
St. 1339, 50 M.W. (2, 110, 140 mm.).
300 M.W. (6, 20—45 mm.).
400 M.W. (2, 25 mm.).
1000 M.W. (3, 80—100 mm.).
St. 1341, 150 M.W. (2, 25, 110 mm.).
200 M.W. (1, 105 mm.).
300 M.W. (2, 25, 40 mm.).
600 M.W. (1, 45 mm.).
St. 1342, 2000 M.W. (1, 80 mm.).
St. 1345, 200 M.W. (6, 20—110 mm.).
1000 M.W. (3, 80—110 mm.).
St. 1352, 300 M.W. (6, 20—30 mm.).
1000 M.W. (1, 25 mm.).
St. 1353, 100 M.W. (2, 85, 102 mm.).
150 M.W. (1, 125 mm.).
200 M.W. (15, 25—110 mm.).
St. 1353, 600 M.W. (1, 55 mm.).
1000 M.W. (1, 85 mm.).
St. 1355, 200 M.W. (1, 20 mm.).
St. 1356, 300 M.W. (8, 20—110 mm.).
600 M.W. (2, 30, 70 mm.).
St. 1358, 150 M.W. (1, 25 mm.).
200 M.W. (3, 25—35 mm.).
300 M.W. (6, 25—65 mm.).
2000 M.W. (4, 20—90 mm.).
5000 M.W. (2, 25 mm.).
7000 M.W. (3, 70—130 mm.).
St. 1360, 100 M.W. (1, 20 mm.).
600 M.W. (2, 70, 75 mm.).
1000 M.W. (2, 90, 100 mm.).
St. 1361, 200 M.W. (2, 25 mm.).
St. 1362, 300 M.W. (2, 30 mm.).
1000 M.W. (1, 130 mm.).
St. 1363, 200 M.W. (1, 20 mm.).
300 M.W. (2, 25 mm.).
600 M.W. (2, 30, 70 mm.).
1000 M.W. (2, 90, 100 mm.).
St. 1365, 100 M.W. (2, 105, 120 mm.).
300 M.W. (4, 20—35 mm.).
3000 M.W. (10, 25—75 mm.).
St. 1366, 300 M.W. (1, 25 mm.).
St. 1367, 600 M.W. (3, 80—90 mm.).
St. 1368, 300 M.W. (8, 20—30 mm.).
600 M.W. (1, 80 mm.).
1000 M.W. (3, 90—115 mm.).
St. 1369, 200 M.W. (2, 25, 40 mm.).
St. 1370, 1000 M.W. (1, 115 mm.).
St. 1375, 600 M.W. (2, 55, 70 mm.).

The stations listed above show that this species was taken right across the Atlantic, and in the Caribbean Sea. It is probable that a good many of the fish were caught when the nets were on their way to the surface. The capture of the largest specimen, 140 mm. at St. 1339 with only 50 metres of wire out, and other catches, e. g. a fish of 120 mm. at St. 1365 with 100 metres of wire out, indicate that adults may occur at no great distance below the surface.

3. CHAULIODUS BARBATUS, Garman, 1899.

Mem. Mus. Comp. Zool. XXIV, p. 271, pl. K, fig. 2.

? *Chauliodus macouni*, Bean, Proc, U. S. Nat. Mus 1890, p. 44; Jordan & Evermann, Bull. U. S. Nat. Mus. XLVII, 1897, p. 585.

Depth of head 6 to 7 in length to base of caudal, equal to length of lower jaw. Oblique denticles at posterior end of lower jaw absent, or distinguished only with difficulty. 15 to 20 branchiost-

egal rays, usually 18 or 19. Barbel well-developed, laterally compressed, with well-developed basal muscles and a cartilaginous axial support. Post-ocular luminous organ usually further back than in *C. sloanei* and *C. danae*. Photophores of the ventral series, I.-P. 10 (11 in one specimen), P.-V.16—19, usually 17, V.-A. 20—23, usually 21 or 22; of the lateral series O.-V. 16—19, usually 17, V.-A. 20—23, usually 21 or 22; of the single caudal series A.-C. 10—13, usually 11 or 12. Total number of photophores in lateral and caudal series 49—52, usually 50 (Fig. 25, C). Unpigmented photophores larger than in *C.sloanei* and *C. danae*, conspicuous to the naked eye; plentiful on the snout, under the lower jaw, along the back, on the fin membranes, in a dense cluster under the caudal peduncle and forming regular paired groups alternating with the photophores of the ventral series. In two specimens examined, with 50 and 51 photophores in a longitudinal series, the vertebrae number 53 and 54 respectively. Dorsal 6; first ray above 6th to 10th photophore of the lateral series. Anal 11—13, usually 12 or 13. Pectoral 11—13. Pelvic 7. In each of four specimens examined there are 4 pyloric caeca.

The collection includes 17 specimens, 80—170 mm. in length to base of caudal, from the Gulf of Panama. If *C. macouni* be the same it occurs also off the Pacific Coast of North America.

List of specimens of *C. barbatus:*

St. 1203, 2500 M.W. (4, 115—170 mm.).
3500 M.W. (1, 120 mm.).
St. 1206, 3500 M.W. (1, 80 mm.).
St. 1208, 1500 M.W. (1, 145 mm.).
2000 M.W. (2, 120, 160 mm.).
St. 1208, 2100 M.W. (1, 165 mm.).
3000 M.W. (1, 165 mm.).
3500 M.W. (1, 135 mm.).
St. 1209, 2000 M.W. (4, 125—165 mm.).
3000 M.W. (1, 130 mm.).

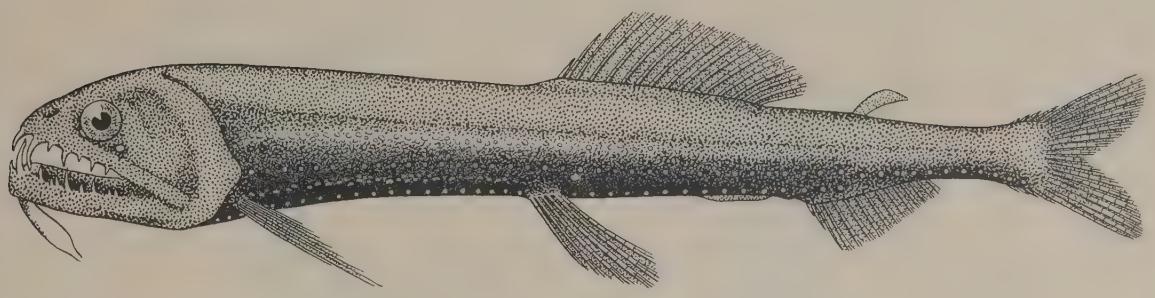
1

2

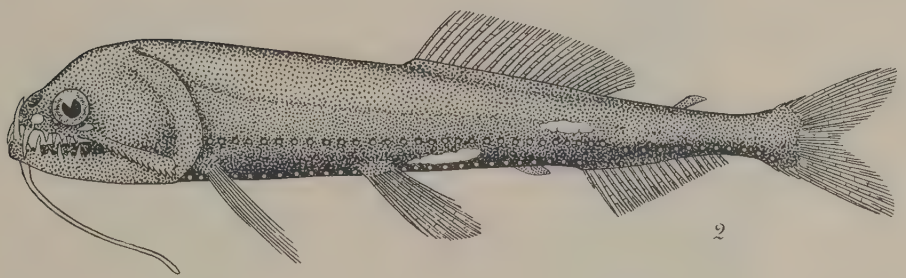
3

W. P. C. Tenison, del.

Fig. 1. *Astronesthes fillfer*, sp. n. ($\times 2^{3}/_{4}$). Fig. 2. *Astronesthes oculatus*, sp. n
Fig. 3. *Astronesthes gemmifer*, Goode & Bean.



1



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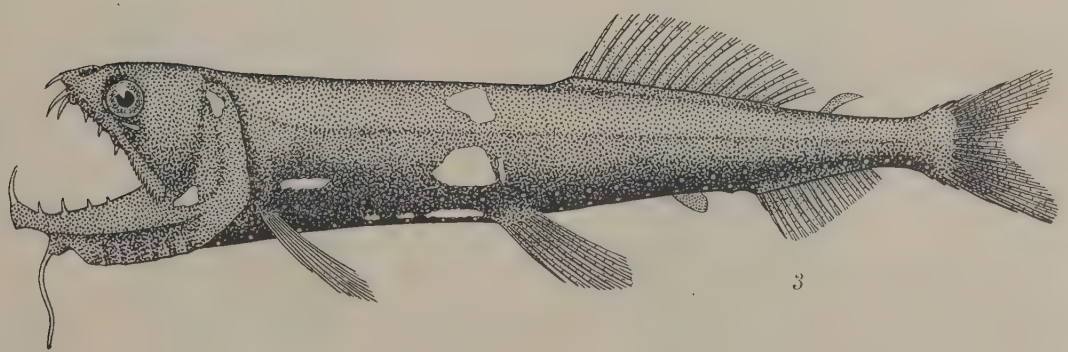

3

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Fig. 1. *Astronesthes neopogon*, sp. n. ($\times 1^1/_5$). Fig. 2. *Astronesthes leucopogon*, sp. n. ($\times 2^2/_3$).
Fig. 3. *Astronesthes indicus*, A. Brauer. ($\times 1^1/_3$).

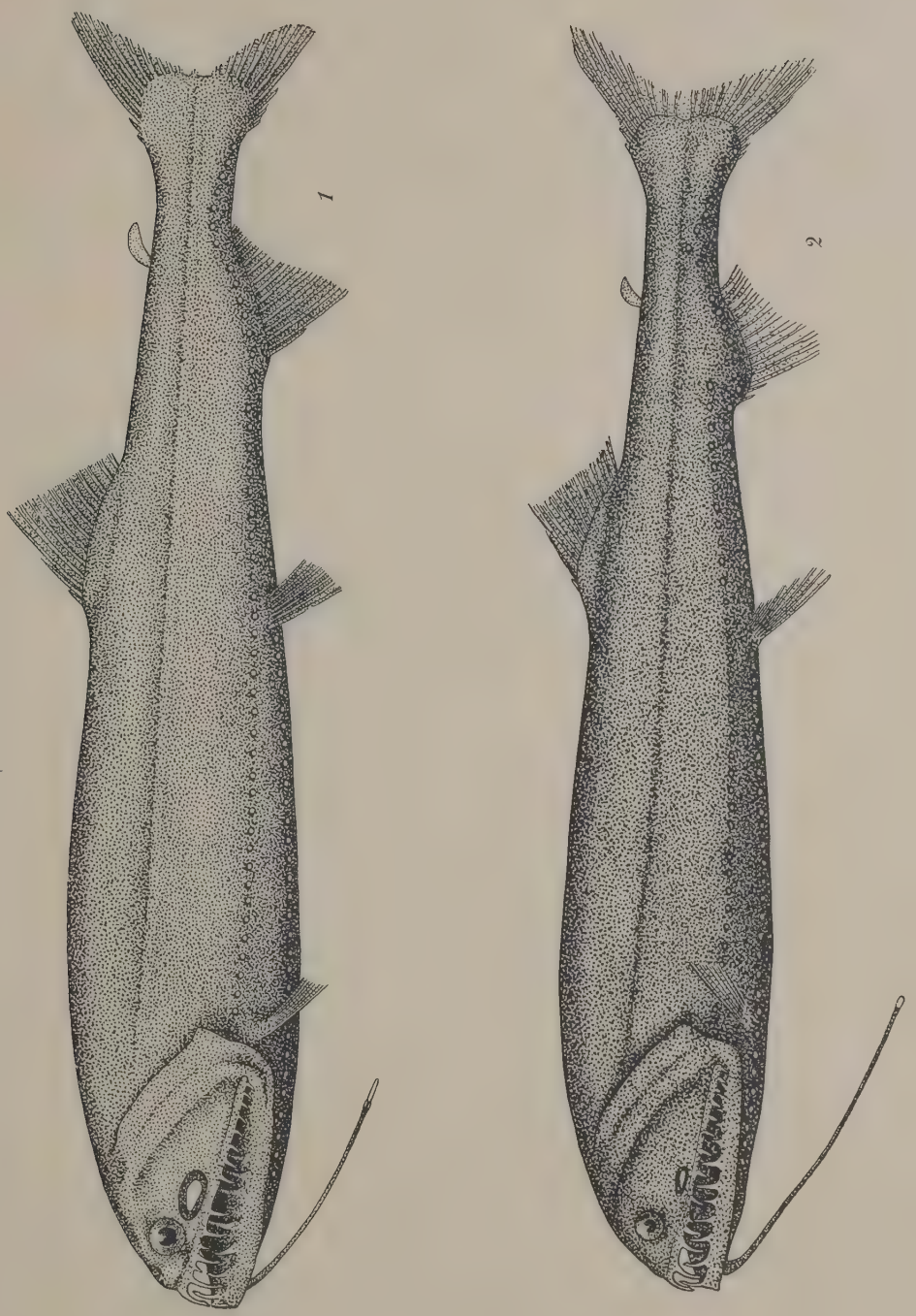

Fig. 1. *Borostomias schmidti*, sp. n. Fig. 2. *Borostomias braueri*, Regan.

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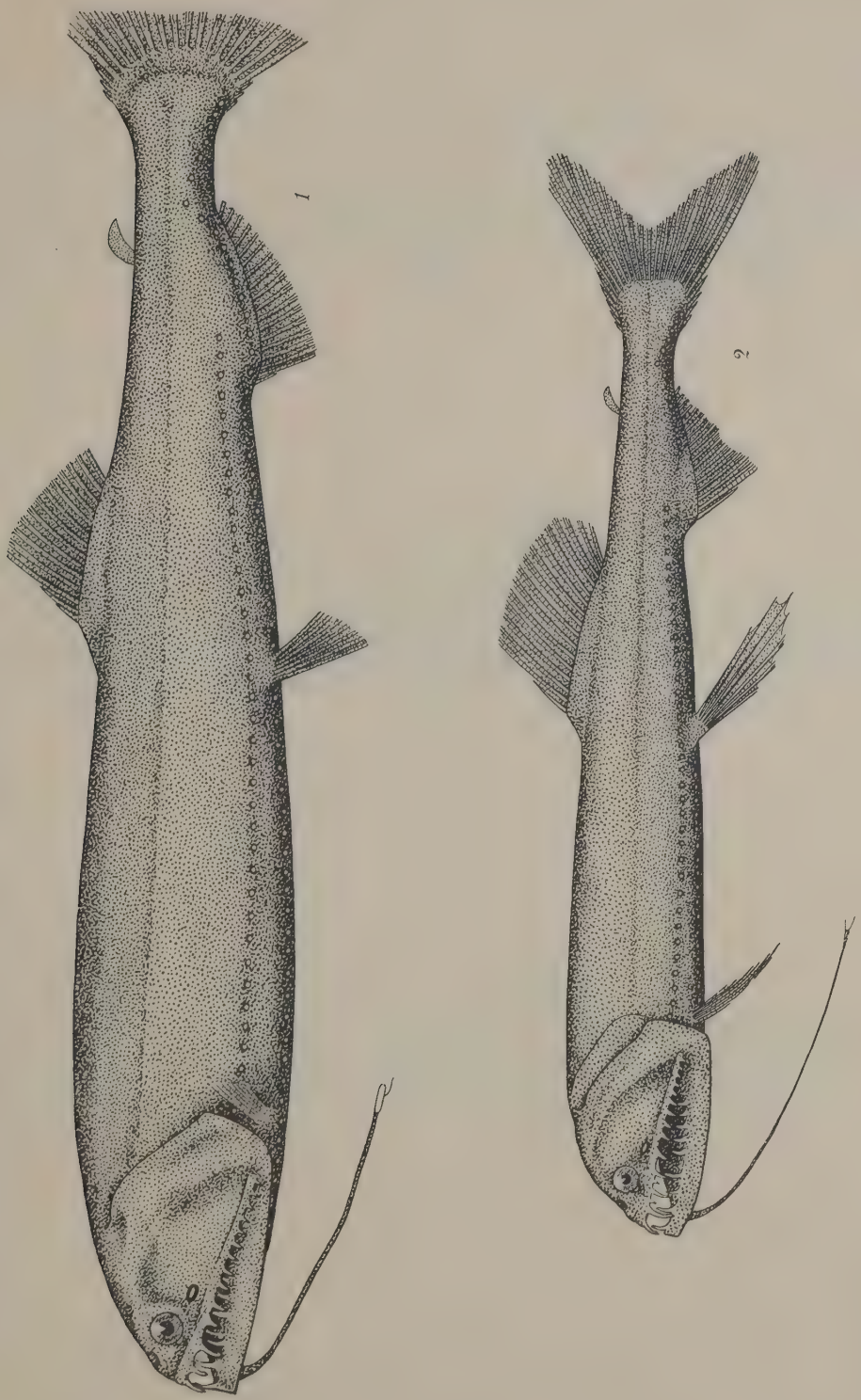

Fig. 1. *Borostomias panamensis*, sp. n. Fig. 2. *Borostomias macristius*, sp. n.

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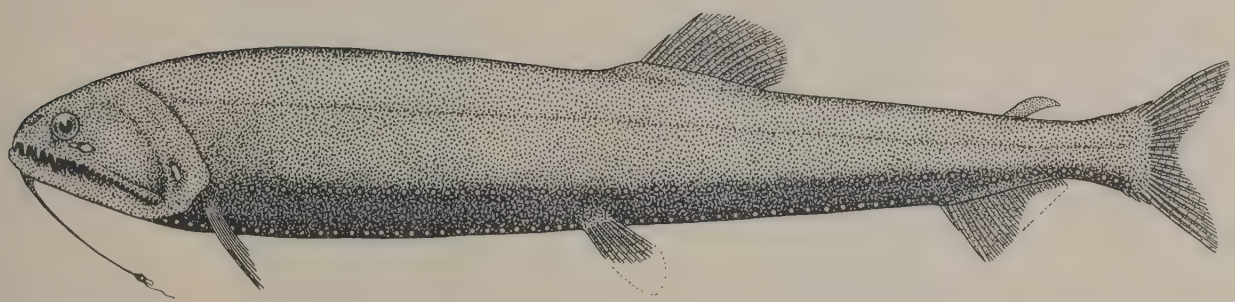
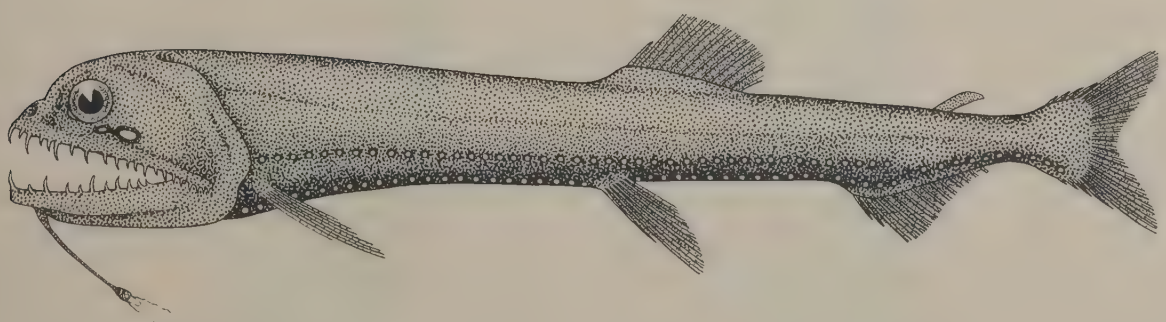
1



2



3

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Fig. 1. *Diplolychnus lucifer*, sp. n. ($\times$ 2/3). Fig. 2. *Diplolychnus mononema*, sp. n. ($\times$ 2/3).
Fig. 3. *Diplolychnus bifilis*, sp. n. ($\times$ 2 1/2).

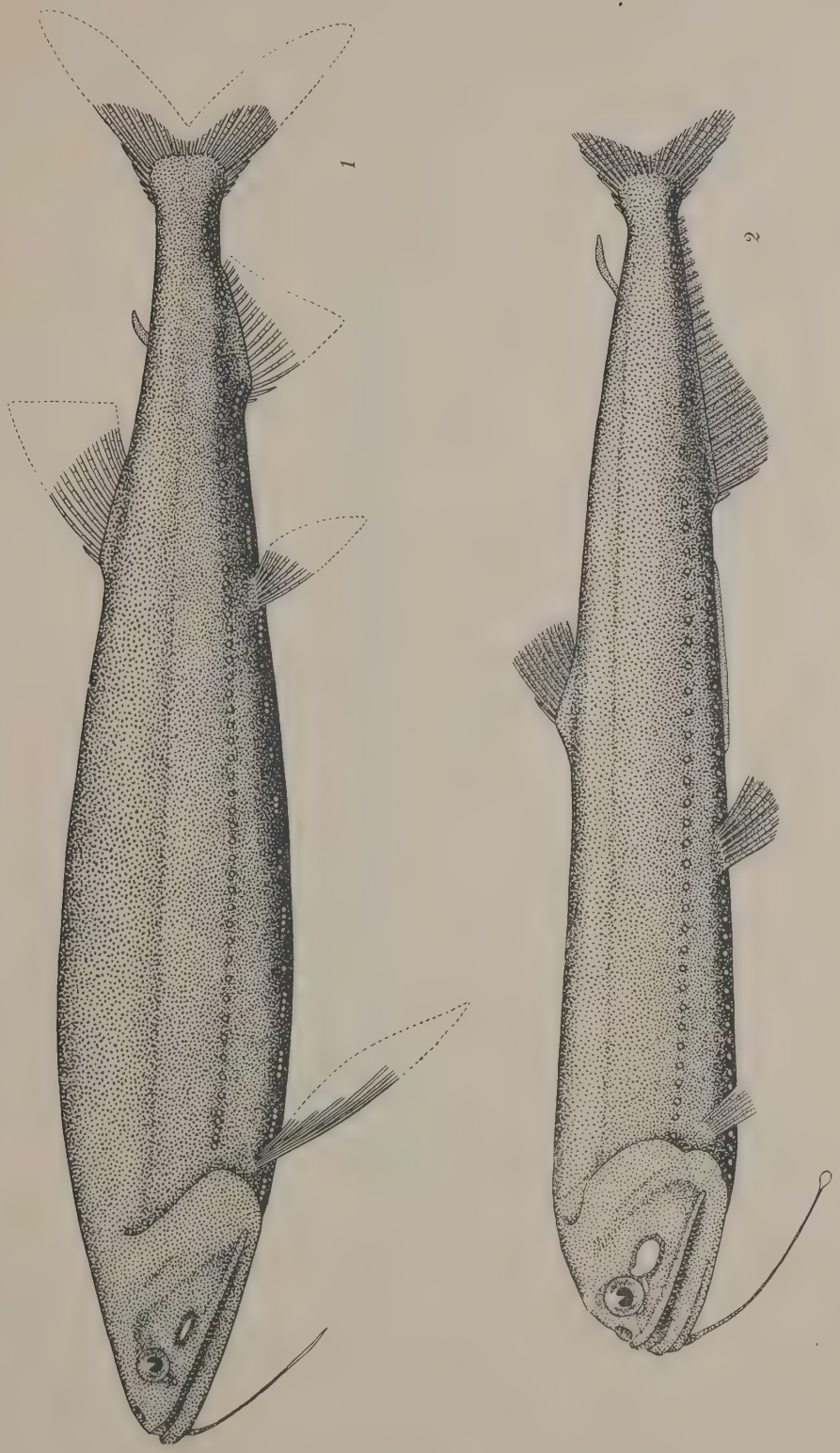

Fig. 1. *Heterophotus ophistoma*, sp. n. Fig. 2. *Neoneslhes macrolychnus*, sp. n. ($\times$ 1/3).

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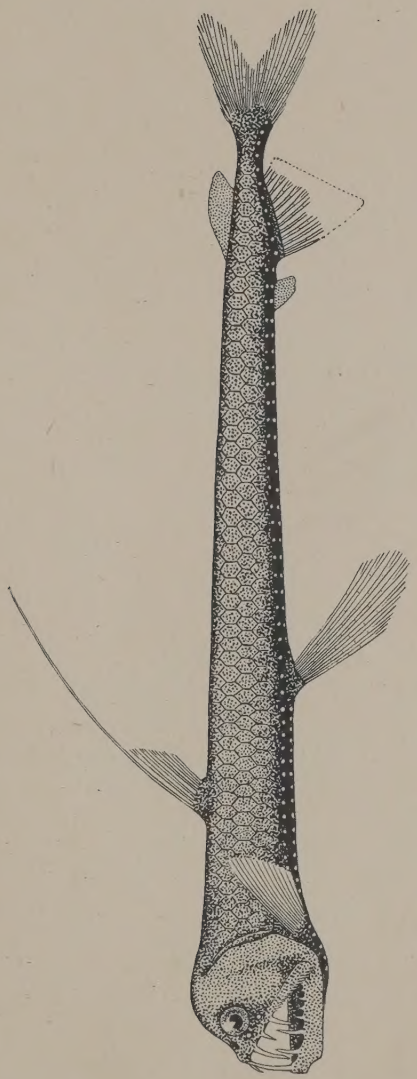

Chauliodus danae, sp. n. ($\times 1^1/_3$).

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